TOOLING & PRODUCTION
Magazine

APRIL 1957

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GRINDING TIME SLASHED BY NEW FIXTURING

by Almon E. Fuller
Group Leader, Process Planning

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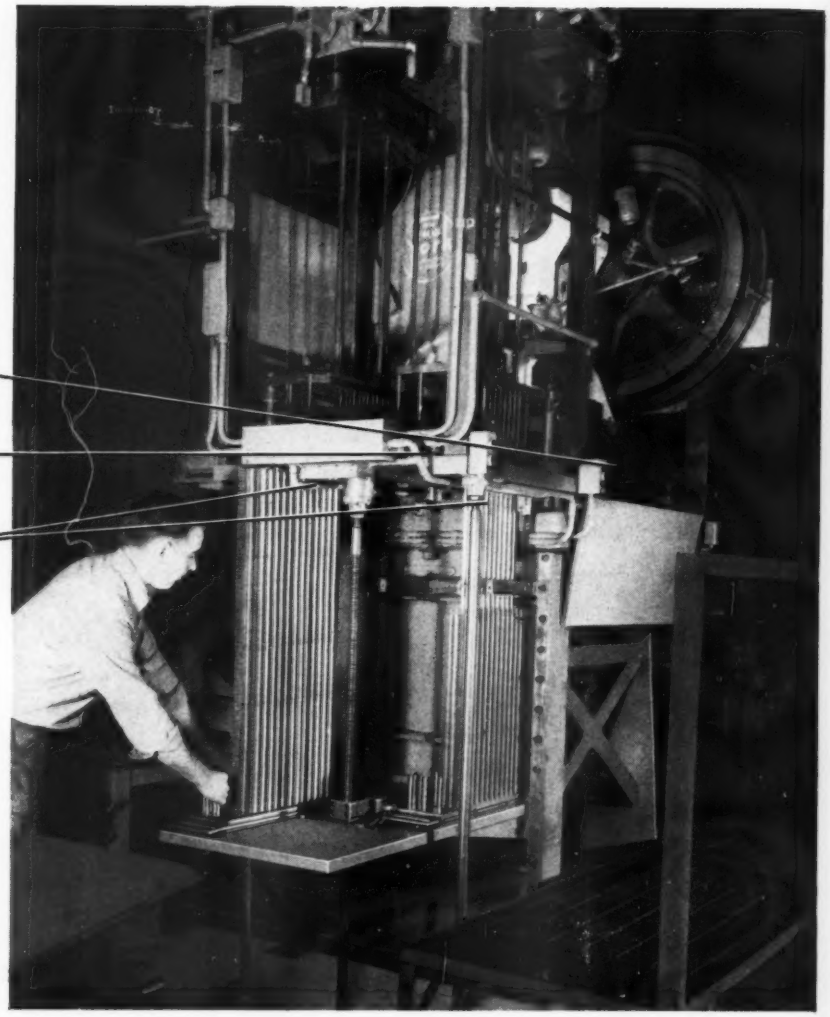
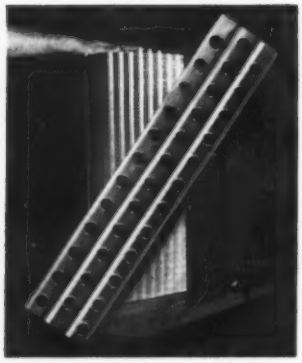


Tooled presses save assembly time at York



Aluminum fins (.006" or .008" gauge) are fabricated and stacked at rates up to 180 per minute.

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Presses and methods that automatically reduce costs

CIRCLE INFORM-A-GRAM KEY NO. 2

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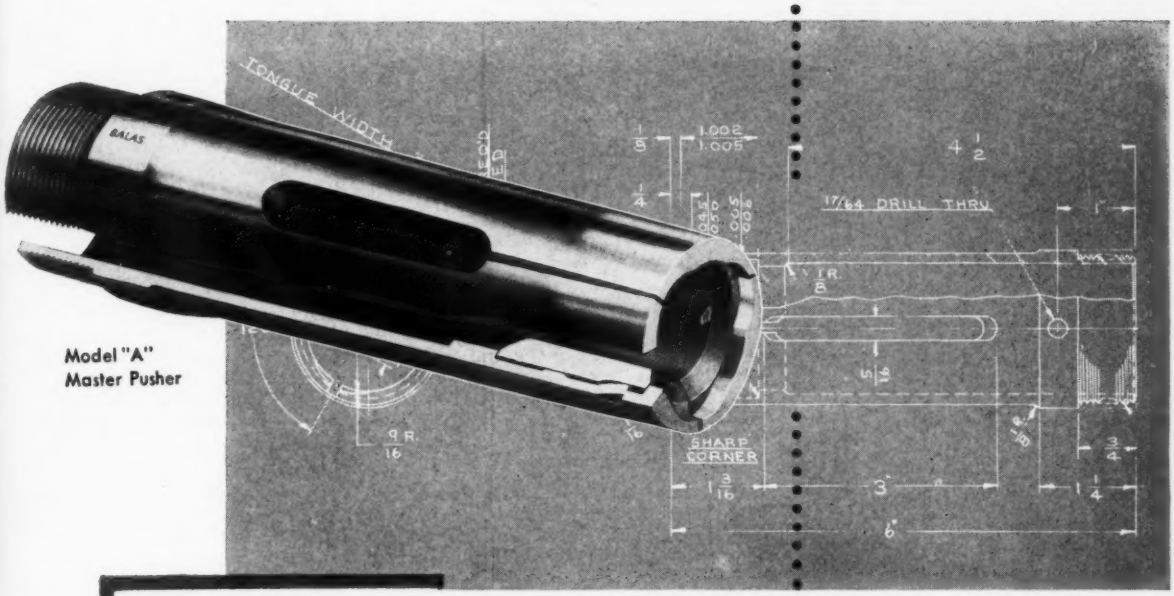
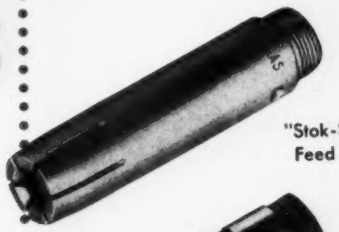
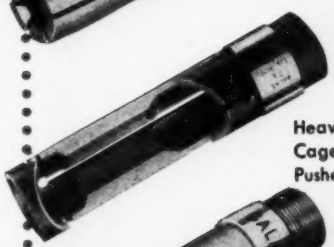


Model "A"
Master Pusher

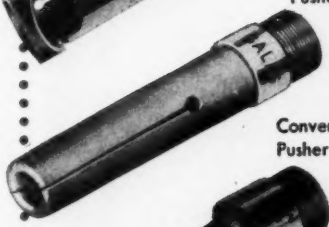
BALAS PUSHERS



"Stok-Saver"
Feed Finger



Heavy Duty
Cage Type
Pusher



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Feed Finger

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CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

APRIL 1957

VOL. XXIII—No. 1

GEORGE J. HUEBNER, Founder

Personally speaking

Dear T & P Reader:

As a "browser through books" of long standing I discovered just recently, much to my temporary consternation, that I was a serendipitist. Said I to myself, "that ain't good!" Sounds like a horrible disease. In fact I told Bill Pennington, our editor, I'd sue him if he were responsible. But Bill knows a lot about long, tough words (I guess he has to) and he promptly set me straight.

Said Bill, digging deep in the lower right hand drawer of his memory; "Why, that just means you have a gift for finding valuable or agreeable things not sought for." (By some strange coincidence this is also the dictionary meaning of "serendipity.")

Anyway, I think a great many of us are serendipitists. When you look up a word in the dictionary and then let yourself get sidetracked reading the difinitions of unfamiliiar words you become a serendipitist. When you read an article in T & P about cold forming operations in spite of the fact that your plant — and therefore you — are primarily concerned with automatic machining, then you join the ranks of those who "find valuable or agreeable things not sought for."

I'm fascinated by the realization of how very much information seeps into our minds in this manner. And, I think it's good. Don't you? In this day of great specialization it's refreshing to meet men who have a broad knowledge of all aspects of their field of work.

Recently, in a conversation with one of our readers, he told me that he only looked for articles on his subject (it happened to be cold forming and joining of steel sheets). He said he didn't have time to read all the articles.

He has my sympathy. I can't read all the things I'd like to read either. But I know that it is very valuable to have a broad knowledge of one's field of endeavor. And I know that a man's value to his firm and to himself is in direct ration to his knowledge of his work. And there is no place to gain this knowledge so quickly as in the editorial and advertising pages of a good trade magazine.

So read broadly; serendip a little. Tomorrow, I hasten to remind you, is another day. And today's browsing might well mean the solution to tomorrow's problem.

Cordially yours,

Ray L. Huebner

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READERSHIP Extension RESEARCH

BPA

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hold close tolerances at

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"Use of the Burgmaster Model 1C turret drill has been a valuable item in space conservation.

Four Burgmaster drills, each carrying six spindles, take up about 15 feet of space at AiResearch, while next to them a line of 20 single-spindle machines occupies three times the space.

The Burgmaster contributes to increased production and more proficient operation by operators, since it permits them to perform in one place a job requiring various types of spindles, which would otherwise necessitate moving back and forth on a line of conventional spindles. It allows use of a stationary jig for operations of various depths and sizes.

Tolerances within .0005 and less can be consistently maintained by the Burgmaster 1C on ream and bore diameters, with .0003 to .0005 on hole locations in jig work."

The Burgmaster 1C 6-spindle turret drill is a sensitive feed, fast operating machine. It features such important benefits as power indexing, preselective speeds and stops, time savings and increased accuracy by elimination of quick change tools. It easily handles holes up to ⅜" in steel. Larger capacity Burgmasters, both manual and automatic hydraulic are available.

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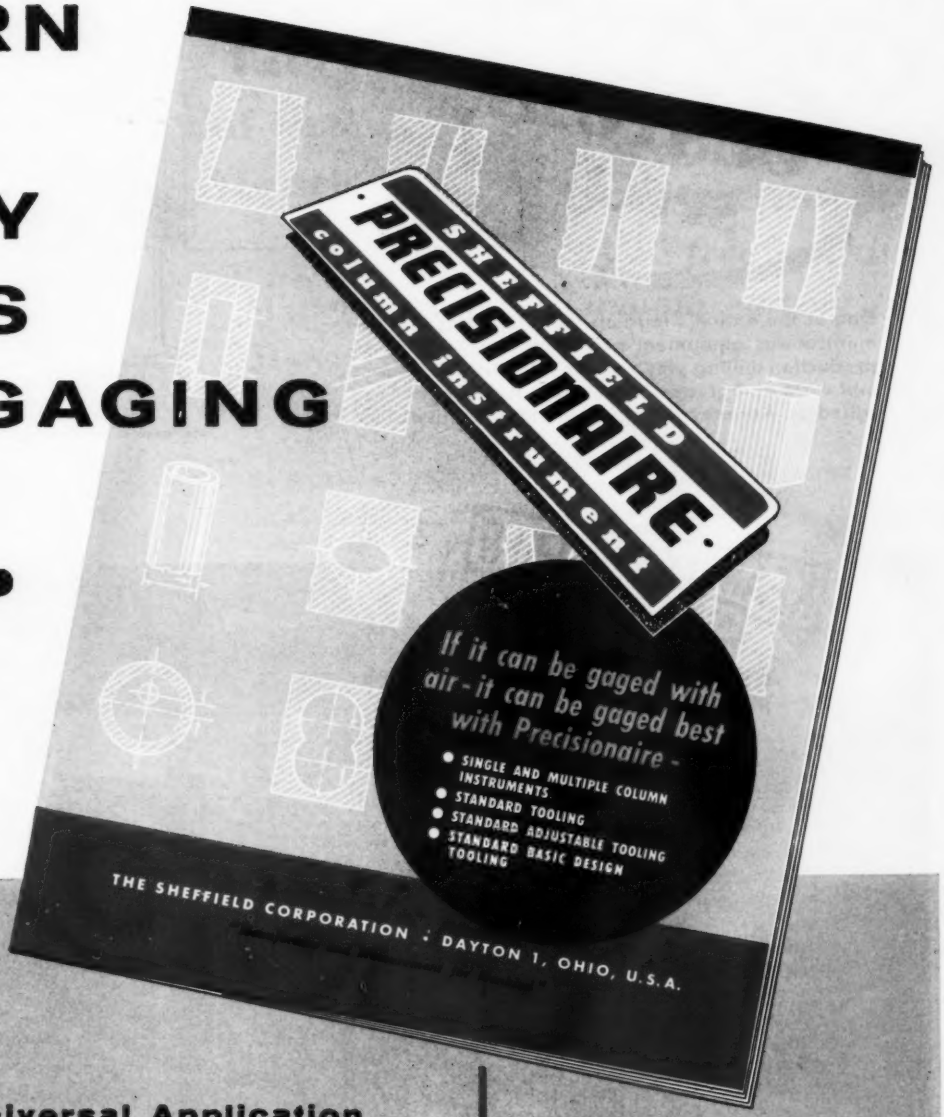
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7718

CIRCLE INFORM-A-GRAM KEY NO. 7

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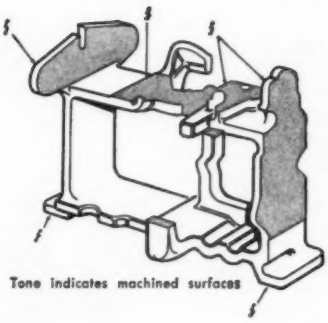
One of the nation's leading manufacturers of communications equipment needed a way to increase production milling of telephone relay frames, reduce unit costs and greatly improve product quality. They called on Kearney & Trecker to solve this problem.

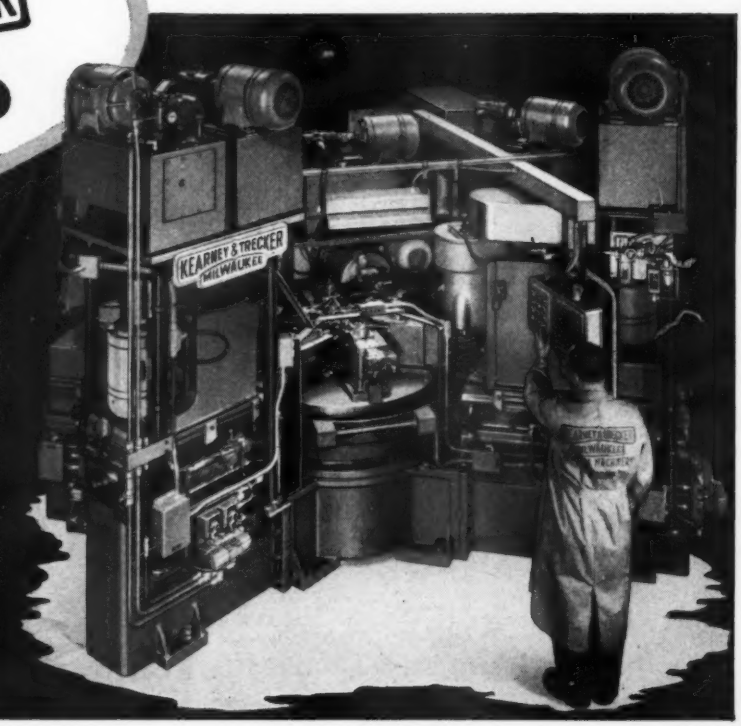


Tone indicates machined surfaces

KEARNEY & TRECKER MILWAUKEE® DESIGNED

Here's Kearney & Trecker's answer: Two 6-Station Rotary Indexing machines which mill 24 surfaces on cast iron telephone relay frames within plus or minus .002" at a combined rate of 360 pieces per hour. Former methods produced only 150 relay frames per hour.

An important cost-saving feature of each machine is the application of standard units — five feed slides and a 48" rotary index table. Such utilization of standard units lowered initial costs, simplified maintenance and increased efficiency.



High-volume, low-cost production starts with Kearney & Trecker Milwaukee machine tools

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Take advantage of our abilities. See how they can pay off in new profits for you. Whatever your production machine needs, call our representative or write: Special Machinery Division, Kearney & Trecker Corp., 6776 W. National Ave., Milwaukee 14, Wisconsin.

For more information on machine illustrated, ask for Data Sheet No. 1083. A new bulletin, SMD-56, which describes many of our outstanding machine designs, is also yours for the asking.

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CIRCLE INFORM-A-GRAM KEY NO. 8

Talk of the Month

MAINTENANCE MANAGEMENT FOR SMALL PLANTS

by William C. Wallin

Chief, Plant Engineering Dept.
North Carolina Works

WESTERN ELECTRIC CO., INC.
Winston-Salem, North Carolina

DURING RECENT YEARS top management has been increasingly focusing attention on better methods to improve the execution of plant maintenance. It is highly important since plant and equipment maintenance costs now average more than 5.0% of the net sales dollar for more than 50 major industries.

Average maintenance expenses continue to increase rather than decline. Increased mechanization, the pushbutton plant, higher speeds, higher pressures and temperatures, new materials handling equipment, instrumentation, electronics, while reducing direct labor, increase and further complicate the maintenance problem.

Management methods and controls devised for production operations must also be applied to maintenance. The opportunities for cost reduction in the maintenance departments of our industries is very substantial and one that should receive constant attention.

In the organization of your "Maintenance Team," thoroughly study the relative advantages of **centralized** versus **zone** maintenance as applied to your specific plant conditions.

Proper organization and direction of employees under either method should be designed to:

1. Reduce excessive clerical work on the part of the crafts and supervision.
2. Minimize travel time.
3. Promote versatility in maintenance crafts, which is most important if lost time is to be minimized.

. . . Continued on Page 12

This article has been adapted from an address made by Mr. Wallin at the 8th Plant Maintenance & Engineering Conference, held concurrently with the 8th Plant Maintenance & Engineering Show, at Cleveland.

FORD

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. . . . free working smooth cutting for

You'll need fewer tools for these jobs because the FORD H.S.S. Uniflute Countersink is designed to handle all three of these operations — in any hole size from the end diameter to the major diameter. The simple single flute design with cam relief does it. Eliminates chatter and secondary burrs. Low in cost, too — and easily re-sharpened in your own shop. We tell you how. Also available in Carbide.

Rotary FORD Tools
WRITE FOR NEW FORD BULLETIN NO. 702

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817 W. River St., Davenport, Iowa

Precision Manufacturer of H.S.S. and Carbide Rotary Cutters Carbide End Mills • Special Tools
CIRCLE INFORM-A-GRAM KEY NO. 9

VASCOLOY-RAMET PRESENTS . . .

VR-

NEW VR-75 quality carbide is a vacuum sintered steel-cutting grade developed specifically for use where high heat is generated. On such work, it will out-perform any grade of carbide available today

AVAILABLE NOW

In throw-away and long inserts for negative rake toolholders

VR-75 is an addition to the standard line of V-R quality steel-cutting carbides which meet 80% to 90% of all steel machining requirements. On applications where severe heat and shock conditions are a problem, new VR-75 is the thoroughly field-proven answer. It is ideally suited to heavy turning, facing, boring and milling jobs where coolants are not used . . . and will also give excellent results on a great many general steel machining operations.

VR-75 gains its exceptional heat resistance, high edge strength and high shock resistance from the special blending of tungsten carbide, titanium carbide, tantalum carbide, columbium carbide and cobalt. Maximum performance is assured by its grain structure and exceptional purity. Vascoloy-Ramet's exacting quality control procedures assure a constant, superior, uniform product.

In the history of the carbide industry, there has never been a higher quality product than new VR-75 steel cutting grade.

For complete information, call your local V-R representative or distributor, or write.

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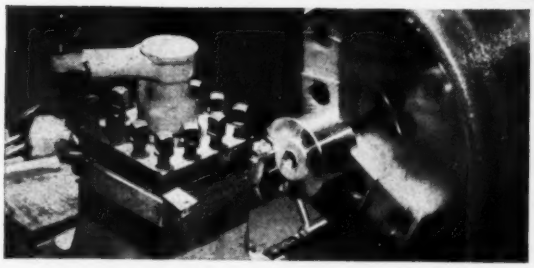
Get complete facts about this cost-cutting carbide today.

-75

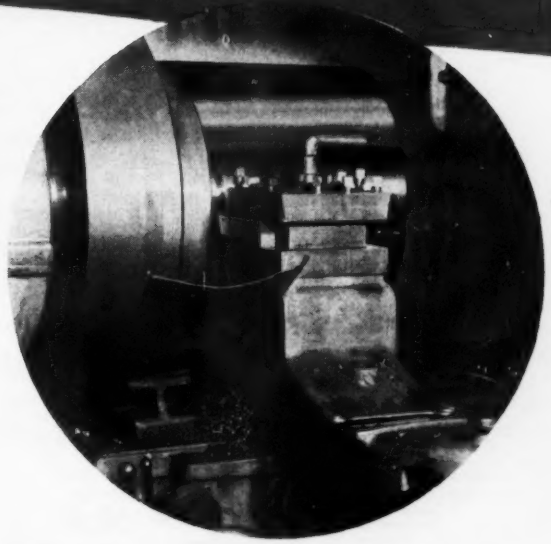
A SUPER STEEL-CUTTING CARBIDE GRADE

NEW VR-75 HAS

- High heat resistance
- High shock resistance
- High edge strength



VR-75 Has Set Performance Records on Jobs from 1" to 36" Diameter



New VR-75 will increase production . . . minimize downtime . . . and drastically reduce tool costs on rough jobs like these:

- Wheel turning
- Roll turning
- High speed milling
- Crankshaft cheeking

. . . and many others.

Vascoloy-Ramet Corporation

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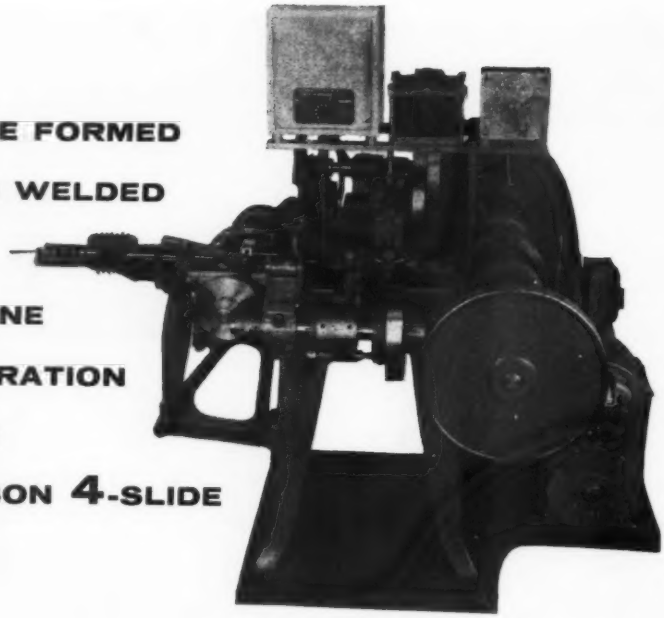
MANUFACTURERS OF: CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 11

WIRE FORMED AND WELDED IN ONE OPERATION WITH NILSON 4-SLIDE



Garter loop formed and welded in one fast operation by Nilson 4-Slide.

Production is increased more than 25% by Hawie Manufacturing Company using a #1 Nilson 4-Slide with welding attachment which eliminates need for ferrule loops in the manufacture of hose supporters. .062 soft basic wire is formed with ends welded in one automatic operation at a conservative 105 pieces per minute. Additional savings are realized in eliminating cost of ferrule.

Another example — Drapery hook is formed with two wires entering 4-Slide simultaneously and automatically welded together at point of contact.

Nilson 4-Slides will produce many types of wire forms similar to the part shown here in which two pieces must be welded or otherwise closed together. By the mounting of automatic welding equipment on the 4-Slide, such parts can be produced in one fast, accurate operation at minimum cost. Nilson 4-Slide Wire Forming Machines are available in a wide range of sizes to handle basic steel wire from $\frac{1}{32}$" to $\frac{1}{2}$" diameter.

A.H. NILSON MACHINE COMPANY

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Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

CIRCLE INFORM-A-GRAM KEY NO. 12

. . . Management from Page 9

4. Provide close coordination between maintenance and production departments.

No general rules can be accepted as to the advantages of area or centralized maintenance without study of the particular situation pertaining to your plant. The plant area, type of manufacturing, and other important factors dictate the best method to be adopted.

There are two types of maintenance work; corrective maintenance and productive maintenance. Corrective maintenance is the repair of breakdowns or the work most people wait for and call the cost "maintenance." Productive maintenance involves any repetitive function, such as inspection, adjustment, cleaning, lubrication, etc., that can be controlled by schedule.

Of the two types, preventive or productive maintenance is the more important. It substitutes the labor cost necessary to hunt up and correct minor troubles, for the cost of waiting until they become major breakdowns and require expensive repair jobs.

Few companies plan their maintenance work to the degree that they plan their production. Many operate on the "fire house" principle. Maintenance planning can be both practical and possible and is highly effective. Experience has shown that planning the work of maintenance craftsmen and crews will improve man and machine effectiveness as much as 10-30%. In the average industrial plant, 80% of the maintenance work load can be planned in advance.

Formalize the authorization of maintenance work with a work order procedure. Convert all jobs into man-hour requirements before the work is started.

Each day, one day in advance, select the work orders in order of priority, emergency, routine, and preventive, and lay out at least one day's work for every mechanic. This may be done in a number of different ways.

Maintenance work can be scheduled from day to day in much the same way as production operations are planned. The important consideration is to provide the foreman with a means whereby he may attain maximum utilization of available manpower and equipment, make adequate preparations for tools and parts, and plan his work so that production operations are interrupted to the least extent possible.

The use of load charts enables one to schedule far in advance only those jobs which tie in with shutdown or with definite dates dictated by production schedules. The priorities of the smaller jobs will change from day to day. Be in a position to measure work loads at any and all times.

ROCKWELL-BUILT

NEW DELTA 15" drill press

...replaces expensive special tooling

The new Delta 15" combines the ruggedness, power and precision of much heavier machines with unmatched power tool versatility. Here's how it can save you money on a wide range of jobs:

DOES MORE WORK MORE ACCURATELY—*Only* Delta offers a selection of *six* spindle adaptors for all production drilling operations—eliminates the need for costly single-purpose machines on many jobs. And each adaptor is mounted on a ground taper for *complete* accuracy, features a threaded collar for *positive* locking.

BIG MACHINE RUGGEDNESS—Delta's unmatched power tool know-how gives you extra rugged design and construction—massive one-piece head, big 2" dia. quill, oversized heavy duty ball bearings—that adds up to years of dependable, low cost operation even under heaviest everyday work loads.

EASY, CONVENIENT OPERATION—*Exclusive "universal" hand feed* combines the best features of pilot wheel and single lever feeds for adjustable leverage, freedom from striking table or fixtures, almost infinite choice of feed lever positions.

Counterbalanced belt guard completely encloses belt and pulleys, swings up for fast, safe speed changes. You get these and many more time and work-saving advantages found in no other 15" drill press!

SEE THE ENTIRE DELTA DRILL PRESS LINE—Get all the facts about the new Delta 15" and other new and improved Delta Drill Presses. Compare—then make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

Send coupon for all the facts!

622D N. Lexington Ave., Pittsburgh 8, Pa.
Delta Power Tool Div., Rockwell Manufacturing Co.

- ☐ Please send catalog on entire Delta Drill Press line.
- ☐ Please send booklet: Delta Power Tools Teamed with Machine Tools.
- ☐ Please send names of my nearest Delta Dealers.

Name_____ Title_____
Company_____
Address_____
City_____ County_____ State_____

another product by **ROCKWELL**

CIRCLE INFORM-A-GRAM KEY NO. 13

. . . Management from Page 12

Review this load at least once each month so that corrective action may be taken before an over-load occurs or the load becomes too light for proper manpower and crew utilization.

An effective program for productive maintenance requires careful study of property, machinery and equipment. To a degree, breakdowns can be anticipated and repairs and overhauls can be performed on a planned basis. The major factors in productive maintenance are scheduled inspections and lubrications, coupled with timely minor repairs, thus preventing large-scale repairs. Basically, the following procedures are necessary to install a satisfactory productive maintenance plan:

1. All machinery and equipment should be numbered for identification.
2. Equipment record cards should be maintained for each piece of equipment, including motors, showing date of installation, HP, name plate data, costs, and other pertinent data.
3. Equipment record cards, or equivalent should be kept in open file. Each card should indicate inspection and lubrication frequencies, dimension changes, repair costs, etc.
4. Repair costs should be analyzed at specified intervals permitting management to determine whether: (a) routine inspection and oiling frequencies are correct, or (b) a major repair job is required, or (c) it is more economical to replace equipment concerned.
5. Establish a complete set of equipment records. Keep a running record of the repair history and repair costs on all major pieces of equipment. Only with accurate repair costs can repetitive maintenance jobs be identified and reduced through redesign or unit replacement.

In considering plant accounting requirements, it is essential that adequate time and material usage reports be maintained for sound accounting. Timekeeping should be centralized insofar as it is practicable, and foremen and workers relieved of these details.

Maintenance costs by departments are important for comparative purposes, as well as being a direct aid in establishing budgets. Reports, however, should be simple, informative, and factual.

Maintenance budgeting is sometimes done in terms of manhours or dollars or in some instances a combination of both. When work measurement standards (hours) are used as a barometer of performance, conversion to dollars can be easily accomplished.

In the case of timekeeping, it is again essential that every maintenance hour be correctly reported and charged properly to work orders or to standing orders. The most accurate method to accomplish this is to time stamp the start and stop time of each job performed on individual job cards. If tabulating equipment is available, man-hour accumulations by jobs may then be readily determined and posted to individual work orders on a weekly basis.

Incentives can be applied to maintenance work to secure the added cooperation of the maintenance employees. Particularly, where incentives for production employees exist, a company may find it highly desirable to provide incentive opportunities to maintenance and other indirect employees. The productivity measurement feature afforded by time standards provides a basis for incentives and a means of sharing cost reductions with maintenance employees.

The extent to which craft and/or departmental incentives are employed will depend largely upon the size and complexity of the maintenance department. Thus, incentives may be designed to reflect the oper-

. . . Continued on Page 33

Style 44-A Ex-Cell-O Carbide Tool Grinder for tools requiring a fine cutting edge. Uses conventional or diamond wheels.
EX-CELL-O

FAST WORK ON A WIDE RANGE OF TOOL SIZES

There's much you'll like about Ex-Cell-O Tool Grinders.

You'll like the power and smoothness made possible by the balanced inbuilt motor spindle that rotates in Ex-Cell-O Precision Bearings.

Ex-Cell-O Tool Grinders, such as Style 44-A pictured above, grind single point tools of carbide, cast alloys and high speed steels to long-lasting, sharp edges. Grooved, hardened steel plates in the tables resist wear and provide a good bearing surface for the tools. All Ex-Cell-O Grinders are double-end models; all use steel back wheels and have large, easy-to-adjust tool rest tables and coolant equipment.

Ex-Cell-O has a tool grinder to fit all types of operations. Why not write Ex-Cell-O or call your local Ex-Cell-O Representative?

EX-CELL-O CORPORATION XLO
DETROIT 32, MICHIGAN

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56 - 53

CIRCLE INFORM-A-GRAM KEY NO. 14

AVOID the **HIGH COST** and difficulty of fabricating long, hard & straight parts by conventional methods . . .

THOMSON

60 Case

hardened and ground

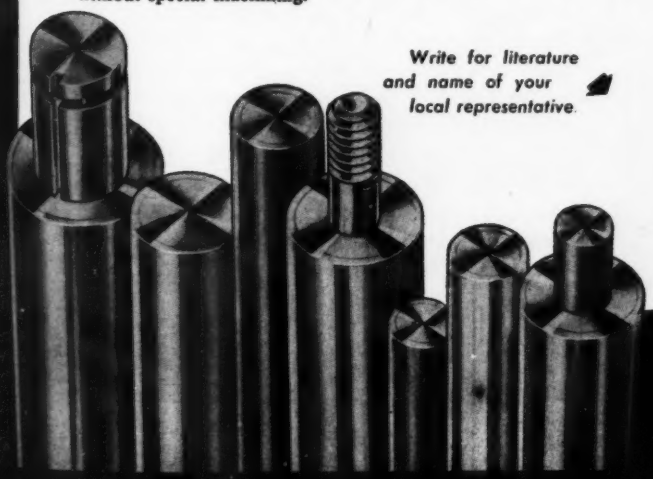
SHAFTS, ROLLS, GUIDE RODS and other long-round parts

60 Case is the result of over ten years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining.



Write for literature and name of your local representative.

ADVANTAGES of *60 Case*

- COST REDUCTION
- HARD BEARING SURFACE
- ACCURATE DIAMETERS
- GROUND FINISH
- STRAIGHT PARTS
- DELIVERY FROM STOCK
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

TYPICAL *60 Case* PARTS

GUIDE RODS, SHAFTING, ROLLS, TRAVERSE RAILS, PISTON RODS, ARBORS, LEADER PINS, TIE RODS, KING PINS, AXLES, CONTROL RODS, GUIDE POSTS, MANDRELS, BEARING ROLLERS, SPINDLES

THOMSON INDUSTRIES, Inc.
Dept. C1, Manhasset, New York

Run fasteners quicker or remove them faster with

THOR Air Impact Wrenches

If you want more punch for the money and tools which will stand up long after others are in the repair shop—you'll choose Thor air impact wrenches every time. You'll choose Thor because you can set and remove fasteners faster. You'll choose Thor because there's no torque reaction to tire the operator. The Thor impact wrenches do the work—not the operator. And Thor gives you the widest selection of tools—¼" to 1¼" bolt capacities—a variety of angle attachments and accessories.

Get Thor impact wrenches on the job today—watch your costs go down tomorrow. Call your Thor factory representative for a demonstration. Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

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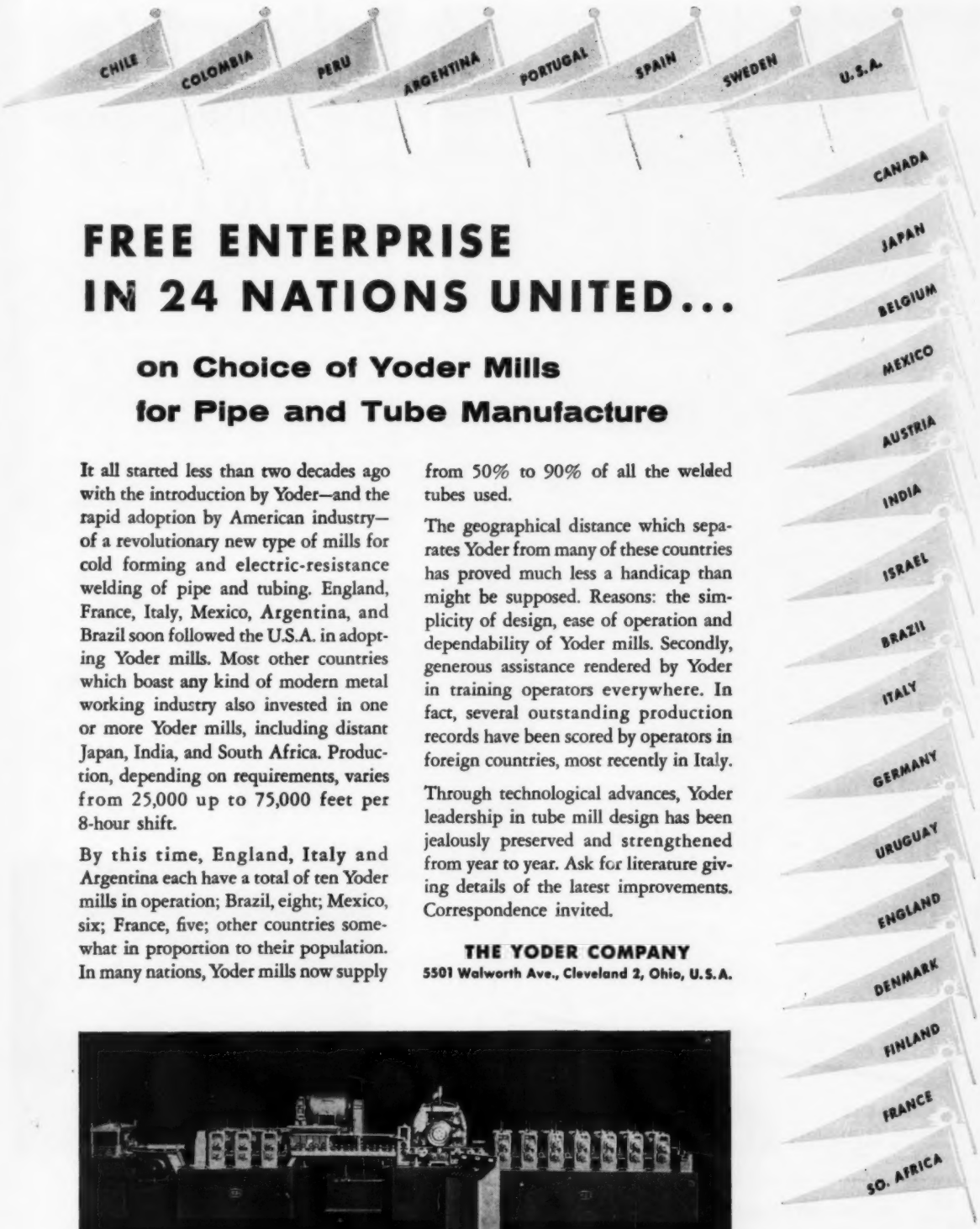
Thor
PORTABLE POWER
TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 16



FREE ENTERPRISE IN 24 NATIONS UNITED...

on Choice of Yoder Mills for Pipe and Tube Manufacture

It all started less than two decades ago with the introduction by Yoder—and the rapid adoption by American industry—of a revolutionary new type of mills for cold forming and electric-resistance welding of pipe and tubing. England, France, Italy, Mexico, Argentina, and Brazil soon followed the U.S.A. in adopting Yoder mills. Most other countries which boast any kind of modern metal working industry also invested in one or more Yoder mills, including distant Japan, India, and South Africa. Production, depending on requirements, varies from 25,000 up to 75,000 feet per 8-hour shift.

By this time, England, Italy and Argentina each have a total of ten Yoder mills in operation; Brazil, eight; Mexico, six; France, five; other countries somewhat in proportion to their population. In many nations, Yoder mills now supply from 50% to 90% of all the welded tubes used.

The geographical distance which separates Yoder from many of these countries has proved much less a handicap than might be supposed. Reasons: the simplicity of design, ease of operation and dependability of Yoder mills. Secondly, generous assistance rendered by Yoder in training operators everywhere. In fact, several outstanding production records have been scored by operators in foreign countries, most recently in Italy.

Through technological advances, Yoder leadership in tube mill design has been jealously preserved and strengthened from year to year. Ask for literature giving details of the latest improvements. Correspondence invited.

THE YODER COMPANY
5501 Walworth Ave., Cleveland 2, Ohio, U.S.A.

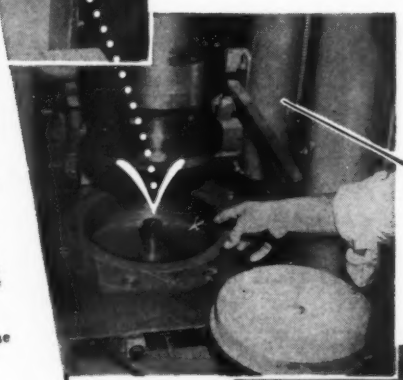
ENGINEERING YODER MANUFACTURING

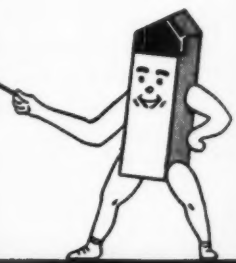
PIPE AND TUBE MILLS—Electric Weld
ROTARY SLITTING LINES
COLD ROLL FORMING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 17

Talide Die
cuts molding cost
7¼¢ to 1¢...

● Simonds Abrasive Company, a leading producer of abrasive wheels, called in a Talide Die Engineer to help reduce excessive die costs. The highly abrasive action experienced in molding the wheels to shape cut service life of hardened steel dies to 3000 wheels. A Talide carbide die having 6" I.D. was designed and, due to its super hard and dense structure, approximately 25 times the number of wheels were pressed! $4,708.80 worth of steel dies would have been required to equal the production of this one $690.00 Talide die. **Metal Carbides Corporation, 6001 Southern Boulevard, Youngstown 12, Ohio.**





SIMONDS ABRASIVE COMPANY
GRINDING WHEELS ABRASIVE GRAINS
TACONY AND FRALEY STREETS PHILADELPHIA 37, PENNA.
TELEPHONE JEFFERSON 6-9100

February 13, 1956

Metal Carbides Corporation
107 E. Indianola Ave.
Youngstown 7, Ohio

ATT: Mr. R.T. Beeghly

Dear Mr. Beeghly:

At the request of your Mr. J.R. Macek, I am forwarding information about our molding die costs for the manufacture of grinding wheels pressed on an automatic press.

When we first began to use automatic presses in our process we set up with steel dies which gave us a molding die cost of $.0725 per piece produced. We then went to Metal Carbides dies which gave a per piece die cost of $.0175. Further changes to a different grade have given a per piece die cost of $.015.

We have recently had one of these dies reworked and have noted still further increase in life and a per piece die cost of $.0106.

Needless to say, we are quite pleased with the results obtained. If we can produce further information, please let us know.

Very truly yours,
SIMONDS ABRASIVE COMPANY
William Kohn
Tool Engineer

WK:RJ

DEEP DRAW DIES

25,680,000 outlet boxes drawn with TALIDE—Steel dies average 700,000.

POWDERED METALLURGY DIES

Compacting highly abrasive chemical powders, TALIDE Pill dies last 4 months, steel dies wore out in 6 hours.

HEADING AND EXTRUSION DIES

Cold-heading ¼" C-1008 steel rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

Send for Catalog 56-G or ask for Talide Die Engineer to call

METAL CARBIDES CORPORATION
MC TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 18

END MILLS ARE OUR BUSINESS . . .
NOT A SIDELINE

TO BEST SERVE YOUR NEEDS

For over twenty years our designing and manufacturing abilities have been devoted to producing highest quality end mills. Because end mills are our business, we realize that universal acceptance of our product is obtained and maintained by continuously supplying the best end mills available.

Putnam manufactures and stocks over 1400 standard types and sizes of end mills. Thus, you can quickly and economically select the exact size and type to best meet your needs.

Putnam Distributors from Coast-to-Coast carry large stocks of standard end mills. Contact your neighbor, the local Putnam Distributor, he will recommend the best end mill for specific jobs, give you personalized service, and quickly supply your needs with the finest end mills obtainable.

PTC PUTNAM TOOL COMPANY

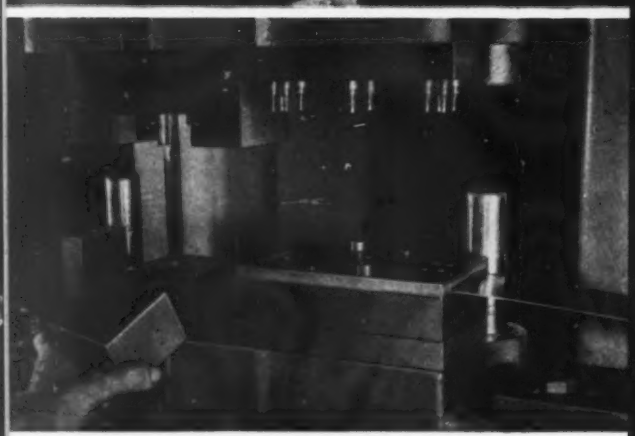
2981 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN

5859

CIRCLE INFORM-A-GRAM KEY NO. 19

Take it from the early birds...

"IT'S THE GREATEST



Niagara Series E 4½ OBI Press in operation at a well known eastern commercial stamping plant. Work includes stamping small wrenches; trimming canopies for electrical fixtures; piercing, cutting off and forming saddles with a progressive die (shown).

Niagara Series E 4½ OBI Press engaged in blanking and drawing of kitchen cannister lids from half-hard aluminum at midwestern housewares manufacturing plant.

"we can produce from 8,000 to 10,000 pieces in an eight hour day"

"much safer press"

"takes less floor space"

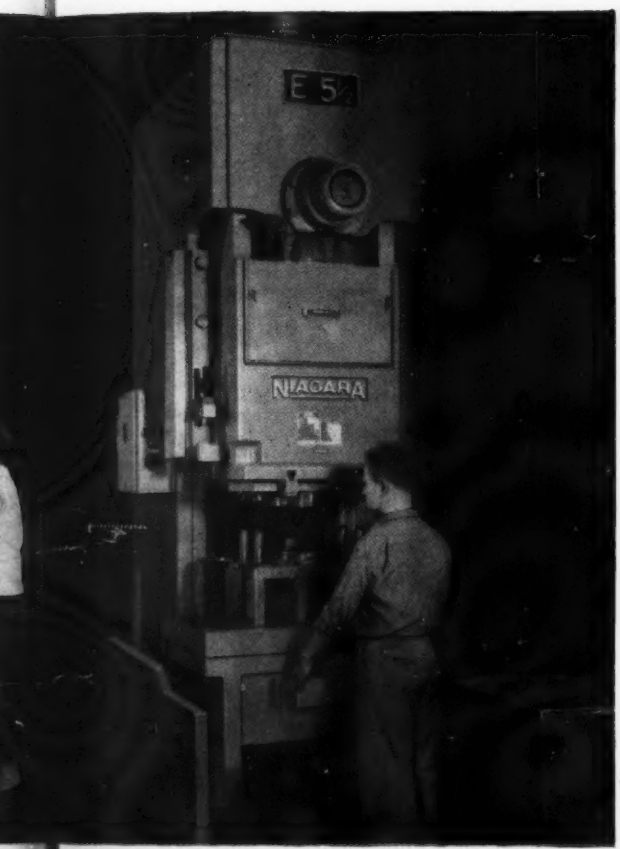
"has a centralized pressure lubricator which we like very much"

O.B.I. EVER BUILT"

"we find that dies without posts work much better on this press"

"all dies give better and longer runs"

"large slide area for large trimming, blanking and progressive dies"



Niagara Series E 5½ OBI Press forming and trimming hemispherical copper parts for one of the "Big Two" electrical manufacturers.

Few developments in metalworking history have drawn the enthusiastic endorsement given Niagara's revolutionary Front-to-Back Crankshaft OBI Press.

Now, as at the 1955 Machine Tool Show where it was unveiled, there is *nothing* even remotely resembling it in the industry... design-wise and production-wise.

Customers in U.S. and Canada... the "early birds" who are doing their modernizing with the most modern press of all... can today tell you about accomplishments with this newest and greatest of OBIs that you would have never dreamed possible. Yes, the press that Niagara conceived to do more than any OBI ever built is doing just that for a fast-growing list of metalworking plants.

There's a huge fund of successful experiences that a Niagara representative can share with you today. Draw on it now and utilize it in your modernization plans. Make a date, at your convenience, for a personal call.

... and if you haven't received new Bulletin 56 with complete design description and specifications (75-200 ton capacities, 4½-7½ inch shaft diameters, standard and automated models) write for your copy at once. You will find it invaluable to your planning.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

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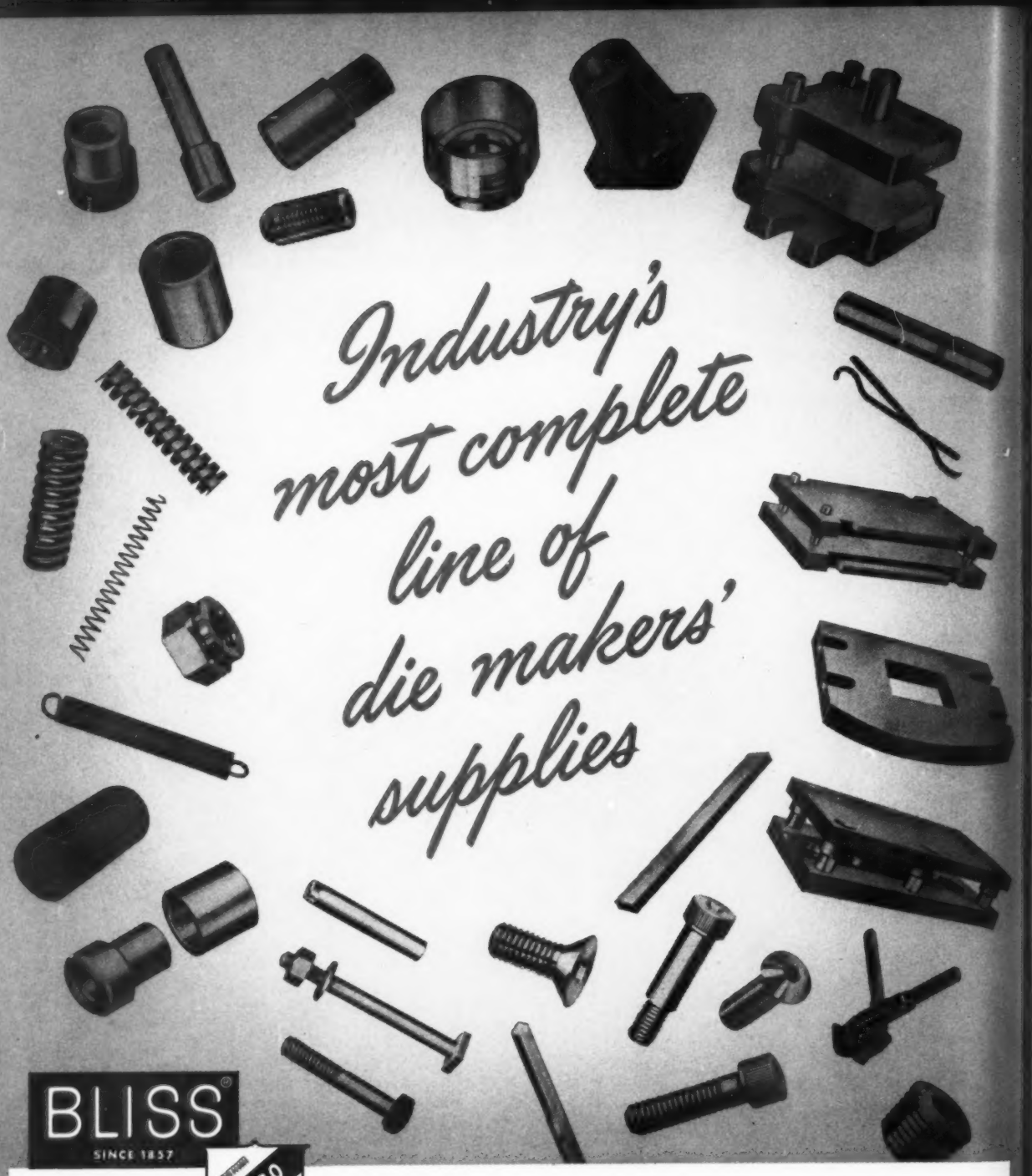
America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

NIAGARA

front-to-back crankshaft INCLINABLE PRESSES



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DIECO

E. W. BLISS COMPANY

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Apex Machine Tool Supply, Inc.

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Tool and Die Supply Co.

MINNEAPOLIS, MINN.
Northern Machinery & Supply Co.

MONTREAL, QUE., CANADA
L. S. Tarshis & Sons, Ltd.

PORTLAND, OREGON
Western Steel Sales, Inc.

SEATTLE, WASH.
The National Company, Inc.

ST. LOUIS, MO.
Scott Special Tools, Inc.

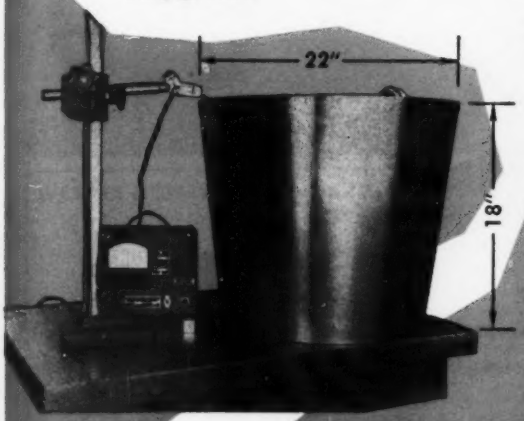
TULSA, OKLA.
Krisman Industrial Supply Co.

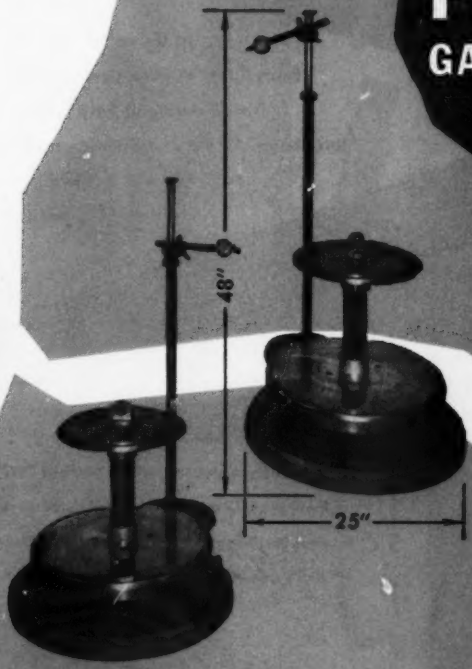
WICHITA, KAN.
Ellfeldt Machinery & Supply Co.

The #00-96 PMCo Thread Ring and Plug Gage appear small beside a 1 inch gage block.

Broad Range of Work Requires

BROAD RANGE OF PMCo GAGES





The Pipe Machinery Company's trademark appears on gages from #00-96 HILO thread setting plug and rings, through the 22 inch diameter taper plug shown.

In more than forty-five years of doing business with the pipe, thread, and metal trades, they have become acquainted with the expert craftsmanship available from the Pipe Machinery Company's team of highly skilled personnel. Our range of work is great, and the degree of quality is always the highest. Wherever you find a PMCo gage, you can be sure it is the finest.

THE PIPE MACHINERY COMPANY

29102 Lakeland Blvd. • Wickliffe, Ohio

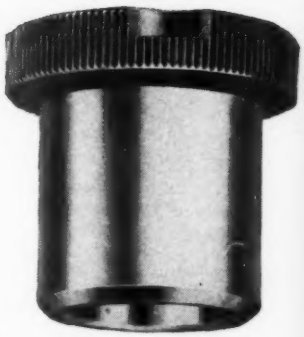
Greater Cleveland

Get the Pipe Machinery Co. fully illustrated Catalog today. Write us on your letterhead.

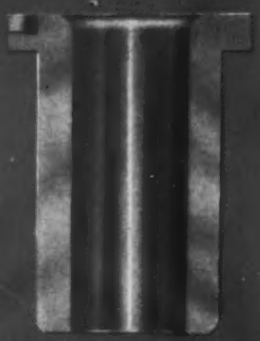
CIRCLE INFORM-A-GRAM KEY NO. 23

for accuracy in your production
it pays to specify

UNIVERSAL DRILL BUSHINGS

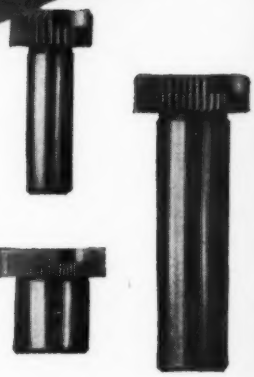


In Universal you get the best. Machined from finest quality steel. Blended radius on the top-inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip.



superfinish bores lengthen tool life

The superfinishing of Universal Drill Bushings is an important factor in keeping tool and bushing wear to a minimum—especially in close tolerance work.

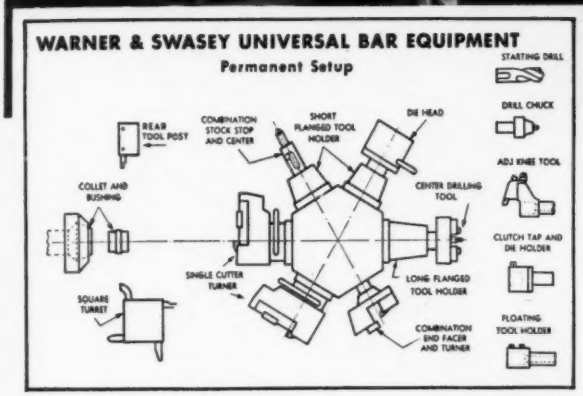


Standard sizes and lengths in stock for immediate delivery. Contact the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

Write for your copy of our new 98 page catalog describing Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Mikro-Lok Boring Bars, Standard Drill Bushings, Universal Index Plungers and other Universal products.

UNIVERSAL ENGINEERING COMPANY | FRANKENMUTH 8, MICHIGAN

Here's a real case of
SMALL LOT PRODUCTION
on No. 3 turret lathes at CAMCO, Inc.



Warner & Swasey Standard Tools are quickly interchangeable for simple or complex jobs—in large or small lots—thus minimizing your tooling costs.

CAMCO MACHINES A WIDE VARIETY OF PARTS LIKE THESE IN 6 TO 100 PIECE LOTS

CAMCO, INC., Houston, Texas, depends on Warner & Swaseys for small lot production of parts for their gas lift valves—equipment which lifts petroleum from oil wells whose natural forces are exhausted.

Two of these nine Warner & Swaseys are standard tooled No. 3 turret lathes which machine a wide variety of simple to complex parts from stainless steel and monel metal, in lots averaging 50 pieces. Tolerances as low as .002 are held on most jobs.

One of the No. 3's is also equipped with a full length lead screw and selective gear box to machine numerous small lot threading jobs. The threads are chased with the lead screw and an automatic knock-off attachment. Specification of the threads: standard vee or round form, special diameter, standard pitches, Class 3.

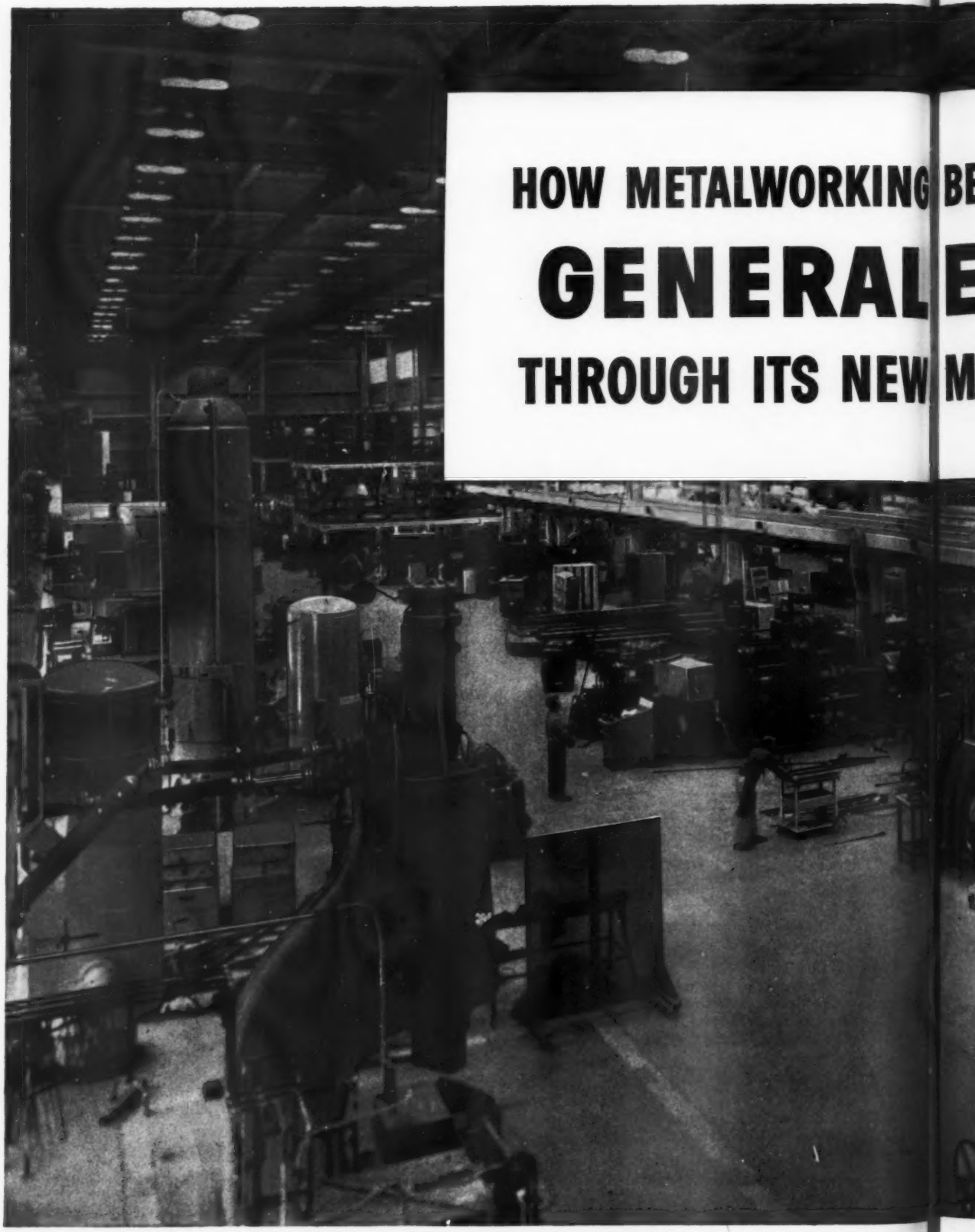
Since the day the first No. 3 machine was installed in 1954, working two 9-hour shifts per day, not one hour has been lost because of downtime for repairs! Similar performance has been achieved by their other Warner & Swaseys—No. 4 and No. 5 turret lathes, 2-A and 4-A heavy duty turret lathes, and two 5-spindle automatics.

This story again illustrates a point recognized in our customers' plants throughout the world—for dependable day-after-day production of small lots, you can't beat the versatility and accuracy of standard tooled Warner & Swasey Machine Tools!

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

CIRCLE INFORM-A-GRAM KEY NO. 25



Laboratory with factory-size equipment—that's the new $5,000,000 G-E metals and ceramics laboratory in Schenectady. From here will come many of the products manufactured by the Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Street, Detroit 32, Michigan

BENEFITS FROM THE RESOURCES OF GENERAL ELECTRIC METALLURGICAL PRODUCTS DEPARTMENT

Solutions to your most pressing problems, plus developments ahead of industry trends, are now being worked out in our laboratories

It doesn't take a crystal ball to know what role cutting tools will play in the Metalworking Industry in the future. The signs are unmistakable.

More accurate casting, extruding, and forging techniques will mean that less metal must be removed by machining. And this will mean that cutting tools must take thinner cuts, and hold closer tolerances.

New and more automatic machine tools will mean that cutting tools must operate at higher speeds – yet provide the longer tool life necessary to give you maximum benefits from automation.

General Electric, through its new Metallurgical Products Department (successor to the Carboloy Department), has already developed several cutting tool materials that are ahead of these trends.

Three years ago, the first of the three Carboloy® Series 300 carbides was announced. Today, these grades permit you to cut harder steels, at higher speeds . . . at lower machining cost per part.

Two years ago, General Electric researchers introduced Cemented Oxide. This material puts mirror finishes on metal, while operating at speeds up to 3000 fpm – far beyond the range of carbides and ceramics.

And last year, G-E Engineers in the Carboloy Machinability Laboratory developed several new machining techniques to help you make better use of these improved materials. One of these techniques lead to a way to utilize carbides at low speeds – starting from 0 fpm – an almost impossible task until now.

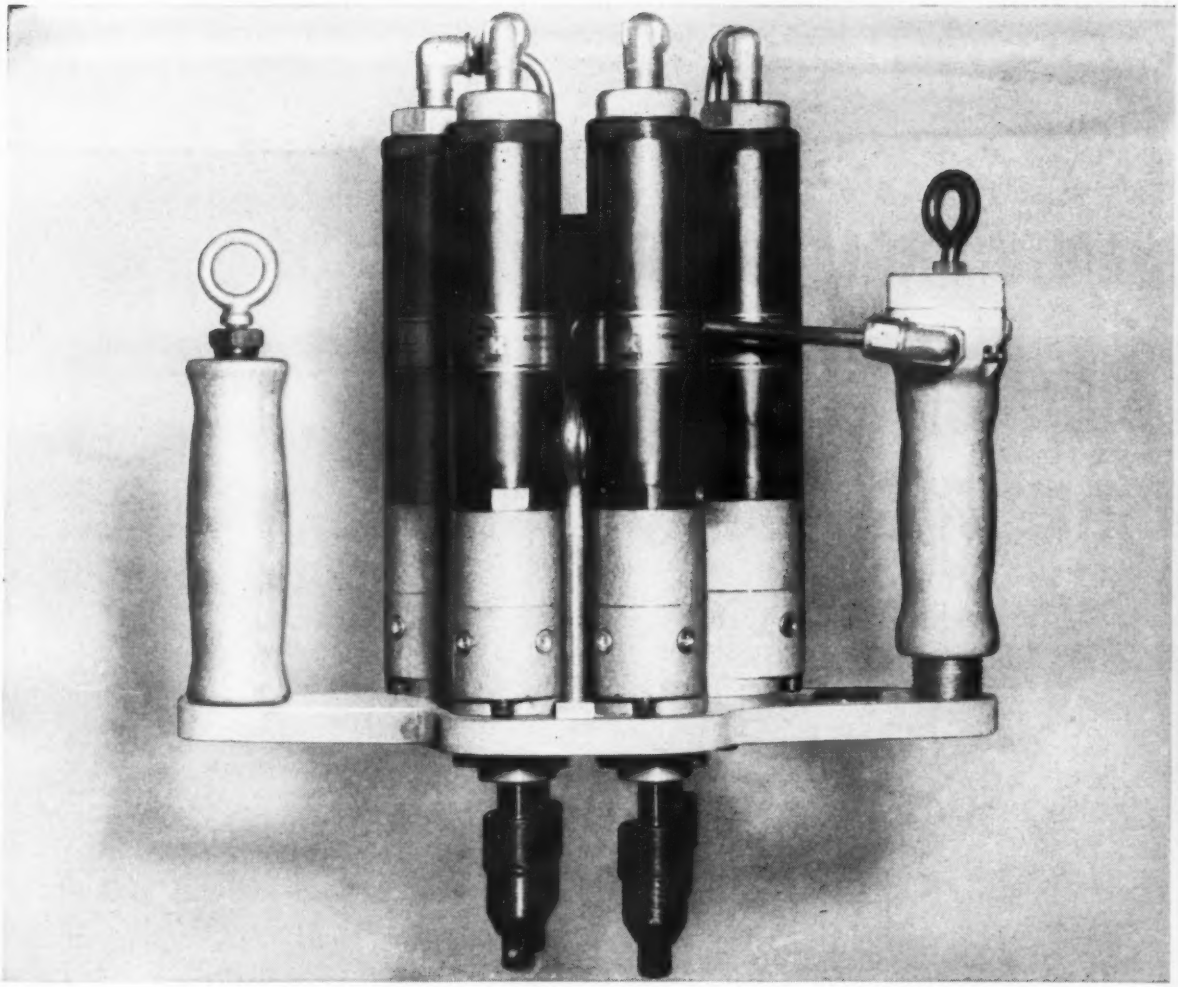
All these developments resulted from the vast technological resources which General Electric has brought to bear on metalworking problems – plus the fund of machining knowledge accumulated since G-E first introduced carbides to American industry in 1928.

These resources and this knowledge mean that General Electric–through its Metallurgical Products Department–will be able to recognize and solve new problems of the Metalworking Industry as they arise.

Progress Is Our Most Important Product

GENERAL ELECTRIC

CIRCLE INFORM-A-GRAM KEY NO. 27



4 to 1 you'll increase output with KELLER "spindle gang"

With a flick of his thumb, the man with the *new* Keller multiple-spindle tool drives four screws at the same time. As a result, his output increased while production costs decreased.

The new medium low-torque (2 to 24 foot-pounds) Keller tool is *made to order from your assembly blueprints*, with any number of spindles. Yet tool cost is relatively low. Only the mounting plate is specially shaped and drilled. Motors and other stock components are standard designs adapted to job requirements.

Convertibility, flexibility of design, uniform torque control, low maintenance and low operator fatigue are winning a place on assembly lines for the entire line of Keller multiple-spindle nut setters and screw drivers, which range in torque delivered from 2 to 190 ft. lb.

Confer with a Gardner-Denver man about increasing your assembly production with Keller multiple-spindle tools. Or write for complete information.

Keller "K-MATIC"* drilling unit is *new*, too!

Combines advantages of mechanized feed drilling machine and portable hand drill. Designed for drilling clean, true holes in hard metals—like titanium, stainless steel, etc. Made to handle drills ⅜" or smaller. Send for free descriptive folder.

*Trade-Mark

GARDNER-DENVER

GARDNER-DENVER COMPANY, QUINCY, ILLINOIS

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

CIRCLE INFORM-A-GRAM KEY NO. 28

Pre-Ground, Pre-Calibrated Monarch *QUIK-TOOL* Ready-Set Tooling Provides Immediate Tool Change

What's Quik-Tool? It's a tool block and set of seven tool holders, all precision ground and pre-calibrated to provide better accuracy of positioning and response than you get from any turret.

And it's fast! Tools automatically position themselves when slipped onto a locating pin and swung into the slot of the tool block. They don't even have to be aligned or clamped into position, as the precision fit of tool holder and tool block insures rigidity and accuracy.

Monarch Quik-Tools are specifically valuable in the toolroom or instrument shop for practically any type of turning, with tools used in any desired combination or sequence. The standard tool setups can be used, without adjustment to tool settings, for a wide variety of jobs. Holders are designed for standard tools and gages.

How about it? Don't you want to know *all* about how Monarch Quik-Tool eliminates lengthy setups and cuts tool change time to seconds? Send for our complete illustrated booklet today . . . . . ***The Monarch Machine Tool Company, Sidney, Ohio.***

Tool block fits any standard Monarch 10" Model EE Toolmaker's or Manufacturing Lathe compound rest "T" slot. Tools can be used in any combination or sequence for turning, boring, facing, chamfering, grooving, necking, threading, knurling, or cut-off. The tools automatically position themselves.

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

Fill Out This Coupon and Clip to Your Business Letterhead, Please

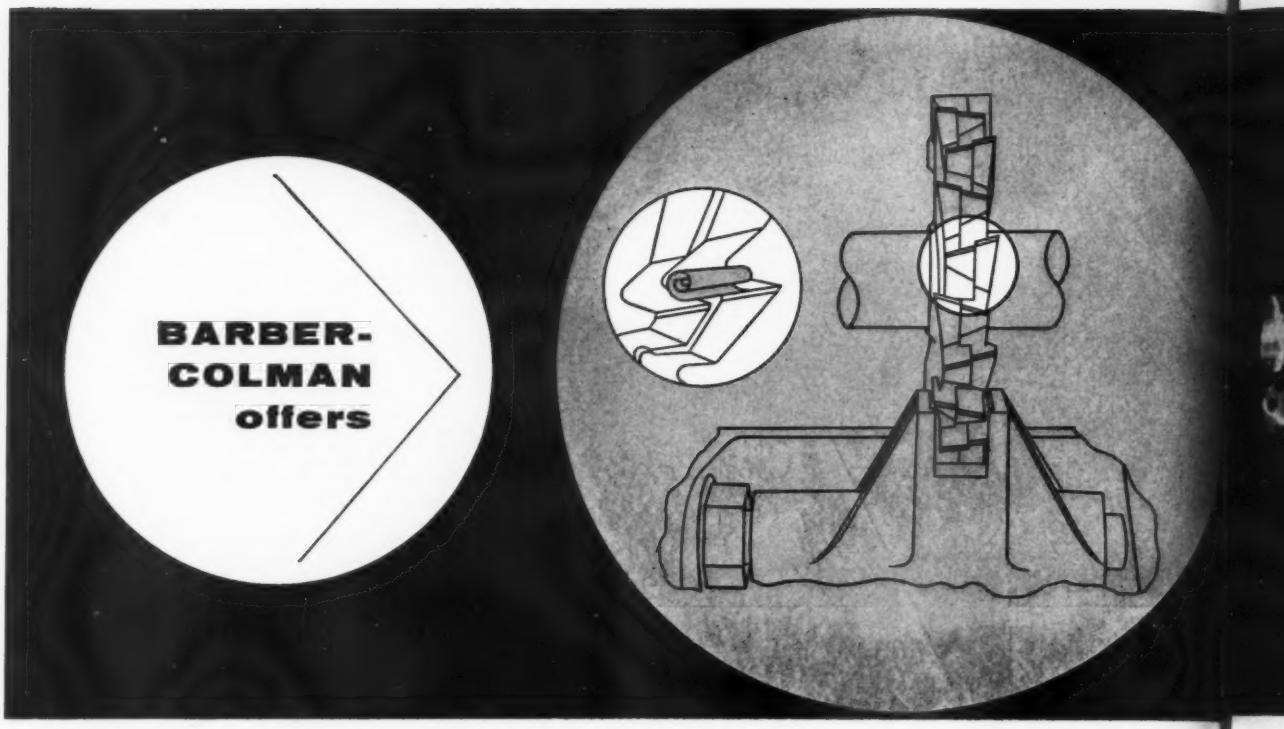
THE MONARCH MACHINE TOOL CO., SIDNEY, OHIO

Please Send Me Your Illustrated Quik-Tool Booklet #306.

NAME_____

TITLE_____

top cutter design improves cutting efficiency and tool life



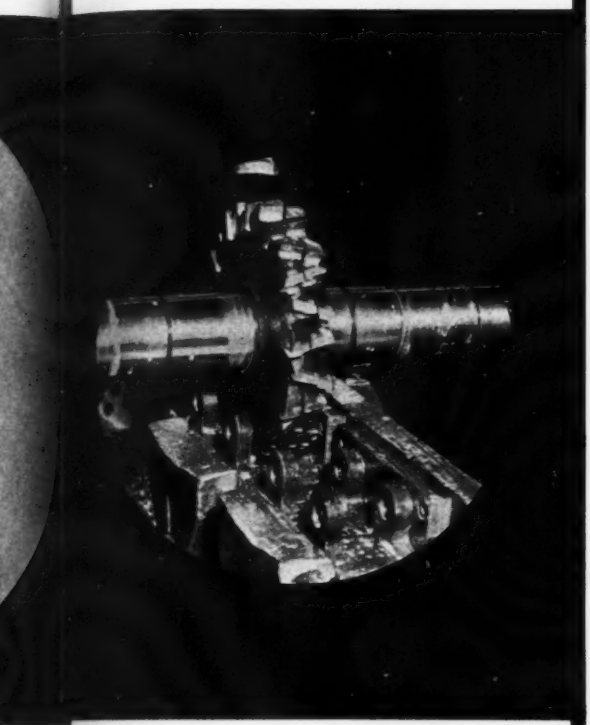
free-flow of chips across cutter face for reduced tooth breakage and increased feeds and speeds*

Improved performance and tool life are provided by these Barber-Colman interlocking staggered-tooth side milling cutters* because chips flow freely across the face of the cutter teeth. The patented interlock of the teeth provides that the entering section of the tooth in the cut is always slightly ahead of the trailing portion so that there is no chance of piling up chips or blocking chip flow. Consequently, these cutters increase tool life and permit the use of greater feeds and speeds.

Cutters of this type are recommended for long deep slotting cuts in steel, shoulder cuts and for milling operations where depth of cut exceeds the width of the cutting face. They work equally well in steel or soft non-ferrous materials. The interlocking feature provides adjustment for accuracy and longer cutter life.

The operation shown here is milling a flywheel clutch cam at Caterpillar Tractor Co. A slot 1″ long x 1⅛″ wide x 1³⁄₁₆″ deep is milled, removing .096″ stock from sides and bottom of cut.

* Patent No. 2,230,662



Compare these figures with operations in your shop:

Part.....Steel Forging, 241–285 Brinell
Cutter Speed.....54 sfm
Cutter Feed.....3.2"/min.
Pieces per Hour.....43
Pieces per Sharpening...344

increases feeds and speeds

Feeds and speeds which could stall conventional type cutters can often be used with this cutter design. The depth of cut may be as great as the depth of the cutter hub without impairing the efficiency of the cutters. Absence of chip accumulations reduces cutting temperatures to allow increased feeds and speeds.

lengthens tool life

This improved design eliminates any obstruction to the free flow of chips across the cutting face. Consequently, chip congestion found on cutters of conventional design is eliminated. Because of this chip action, cutting edges will produce many more pieces per sharpening. The absence of chip congestion also removes a major cause of tooth breakage.

guarantees accuracy

Through the interlocking feature, accurate slots can be milled throughout the life of the cutters. The width of conventional cutters becomes undersize with sharpening and they must be discarded or used for other work. The width of interlocking cutters, however, can be accurately controlled throughout the life of the cutters by using shims between the sections. Several widths of slot can be milled with the same interlocking cutter by using shims of varying thickness.

These special cutters are only one example of Barber-Colman cutter design, specifically suited to particular job requirements. When you have milling problems, consult Barber-Colman Cutter Engineers for recommendations. Send us blueprints or a trial order for your special cutter requirements. Get top cutting efficiency through top cutter design.

BARBER-COLMAN COMPANY

8104 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

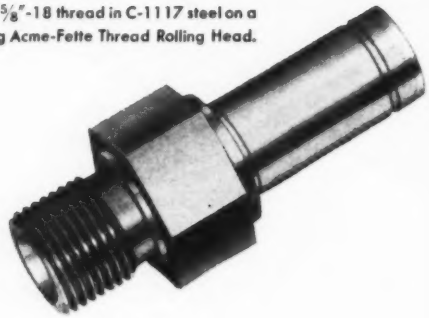
BARBER COLMAN

CIRCLE INFORM-A-GRAM KEY NO. 31

Acme-FETTE

. . . cuts costs . . . **ROLLS** *better threads . . . faster*

JOB FACTS: Rolling a $\frac{5}{8}$"-18 thread in C-1117 steel on a Type N-2 self-opening Acme-Fette Thread Rolling Head.



even on this short run

threading costs reduced from 50 cents to 1 cent per piece

As reported by Mr. Arnold Thompson, President, Thompson Tool and Manufacturing Company, Franklin, Ill., manufacturers of the "Dress-O-Grind" grinding fixture.

When thread chasing failed to provide the required finish for this Class 3 thread fit air rotor—and thread grinding proved too costly—this manufacturer turned to *thread rolling*, using the versatile* new N-2 Acme-Fette Self-opening Thread Rolling Head, on a hand screw machine.

"As a result," states Mr. Thompson, "on a test run of only 1000 pieces, our threading cost dropped from 50 cents to one cent per piece . . . and we maintained the finish we had to have throughout the run, without a single adjustment."

While the Acme-Fette Thread Rolling Head has built its reputation on long runs (often running into the millions) don't overlook the many advantages it offers—*even on short runs!*

"THREADING FROM THE END IS NOW POSSIBLE ON YOUR PRESENT ROTATING OR NON-ROTATING SPINDLES

Provides smooth, extremely accurate and tougher threads—without skips—up to 5 times faster than thread cutting methods.

WRITE FOR BULLETIN NAF-51 FOR DETAILS

National Acme

. . . Management from Page 14

ations of individual crafts or may embrace an entire department. When multicraft participation exists, a combination of both craft and department can be used.

Should incentives be desirable for your plant, time standards for control will be required. The method or combination of methods used should be influenced by the amount of data presently available, the degree of development of existing maintenance controls, personnel available, and other considerations.

Earned hour control requires that manpower utilization be reported weekly by reporting actual performance against an official standard.

Downtime is highly important as a standard against control. In some plants, the effectiveness of both productive maintenance and work scheduling may be measured by the operating performance of certain key units. In a paper mill for instance, the log of the paper machines will bring to light failures of pulp preparation equipment as well as breakdowns on the machine itself.

A graphic presentation of downtime provides an excellent control report.

Control reports are frequently considered by some as truly an unnecessary evil. To assure smooth operation of any maintenance activity, certain control reports must be established which will provide information indicating the degree of effectiveness of the work being undertaken.

Maintenance spare parts and material control are very important functions of maintenance management. Having the proper materials available when they are needed while holding the dollar investment down presents a real challenge.

The following points are considered good criteria for successful storeskeeping:

1. Keep the storerooms locked
2. Review usage periodically and establish reorder points and replacement quantities scientifically.
3. Provide sufficient stores personnel to service mechanics with minimum delay.
4. Provide scheduled delivery service if your plant is large.
5. Segragate and identify material purchased for special jobs.
6. Maintain accurate and current stores records.
7. Have separate bins for each item. Use bin location index.
8. Locate fast moving items near the issue window.
9. Don't complicate the paper work of low cost items.
10. If maintenance stores is not responsible to plant engineer or maintenance superintendent, be sure that authority to designate the items to be stocked and their supply levels is given to the

Jarvis Adjustable Pitch
LEAD SCREW TAPPER

NEW!

. . . a cost-cutting OPPORTUNITY you can't afford to miss! One tapper . . . one lead screw . . . convertible in SECONDS to tap *different* pitches!

ANOTHER Jarvis FIRST!

send this coupon TODAY!

Jarvis Corporation
Middletown, Connecticut

Yes! I am interested in this new, Jarvis First—the Adjustable Pitch Lead Screw Tapper.

☐ Send details and prices
☐ Have a Jarvis representative call
☐ We would like a demonstration in our plant

NAME..... TITLE.....
COMPANY.....
ADDRESS.....
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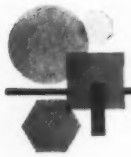

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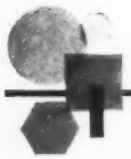

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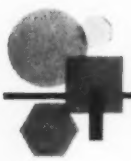

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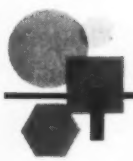
265 Pennsylvania Avenue, Hillside New Jersey



WHEELOCK, LOVEJOY & COMPANY, INC.

12989 Greeley Avenue, Detroit Michigan

7 WAREHOUSES AT YOUR SERVICE

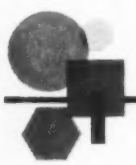
You'll get quick action on your order for alloy steel bars, billets or forgings . . . no matter what size, shape or heat treatment you require . . . when you call any one of our seven warehouses.

All seven are conveniently located in principal industrial areas. Each is staffed by expert metallurgists, and is well-stocked to give you speedy service.

Fill your current needs by ordering our own HY-TEN steels, the "standard steels of tomorrow", or standard AISI or SAE grades.

Or write today to our Cambridge office for your *free* Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

In Canada: Sanderson - Newbould, Ltd., Montreal and Toronto



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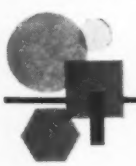

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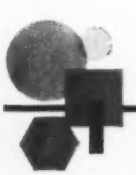
4524 W. Mitchell Avenue, Cincinnati Ohio



HOME OFFICE:

WHEELOCK, LOVEJOY & COMPANY, INC.

135 Sidney Street, Cambridge 39 Massachusetts

CIRCLE INFORM-A-GRAM KEY NO. 34

plant engineer or the maintenance superintendent.

What are the prime requirements of a satisfactory maintenance control plan? Let's look at the organization that should normally administer the plan.

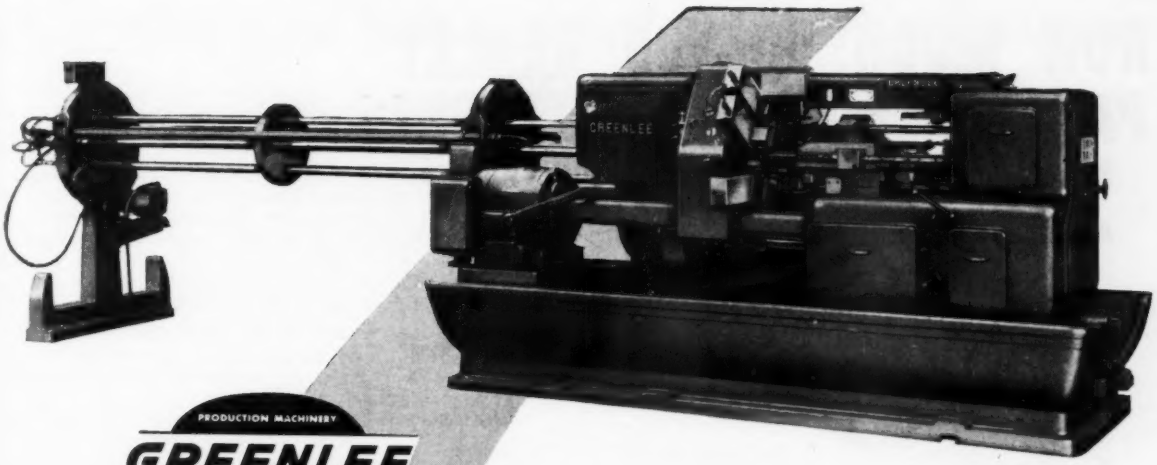
Maintenance, as a function, ordinarily should be responsible to the plant engineer. The plant engineer should not be a part of the plant production organization. The reason is obvious; it's not a human trait to report one's own faults or failures to top management. Separation of production and maintenance — engineering forces will serve to keep management informed of such things as improper use of equipment (by production forces) or inadequate lubrication (by maintenance forces). A maintenance superintendent or foreman may or may not be needed under the engineer, depending on the plant's size.

Principles of plant maintenance require that an adequate and clearly defined organization to conduct all phases of plant engineering and maintenance work be provided. It is essential that your organization

1. Be familiar with condition of all plant equipment.
2. Schedule all inspections and lubrications.
3. Have an adequate work order system for requesting and authorizing work.
4. Set up proper timekeeping practices designed to provide costs by work order and by item of equipment.
5. Size maintenance crews in accordance with current and long range work loads.
6. Plan the work of each mechanic at least one day in advance.
7. Establish maintenance stores requirements based on actual or estimated usage assuring that proper materials are available when needed, while holding dollar investment down.
8. Create employee interest and participation by top management through establishment of work measurement standards and preparation of earned hour control reports.

As to the methods for achieving these principles of plant maintenance, it is suggested that

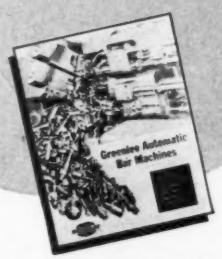
1. Studies be made of suitability of tools and the possible use of the pre-assembled kits of materials. The potential use of portable staging, pipe machines, welding machines, etc. should be determined.
2. Job conditions should be studied with a view of ascertaining where improved methods are applicable. Crew sizes should be determined from actual studies, rather than from off-hand opinions. Load charts are effective for this purpose based



PRODUCTION MACHINERY
GREENLEE

AIR-FEED AUTOMATIC

1. **Permits Greater Job Versatility**
2. **Easily Adapted to Multiple Feedouts**
3. **Provides Longer Stock Feedout**
4. **Eliminates Stock Scoring**
5. **Reduces Stock Reel Noise**
6. **Eliminates Stock Pushers**
7. **Eliminates Feedout Cams**



Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY
GREENLEE

2044 MASON AVE.
Rockford, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 35

HOW MUCH DO YOU REALLY PAY FOR MILLING CUTTERS?

Hidden costs make inserted blade cutters more expensive than you think!

HERE'S PROOF!

One piece Carbide Tipped cutters have many advantages over inserted blade cutters-better finishes . . . more rigidity . . . closer tolerance milling . . . and one piece safety.

Now here is *proof* that solid cutters also save money hour after hour . . . day after day. Don't be fooled by the "do-it-yourself" replacement blade cutters-they're more expensive than you think.

NELCO Cutter Number	TOTAL COST NELCO Solid Tipped Cutter	Replacement Blade Cutter	COST Equivalent Replacement Blade Cutter	COST of set of Replacement Blades*	REMARKS
6104S	31.00	A	75.00	18.00*	Cost of Complete do-it-yourself cutter and two sets replacement blades $111.00 + replacement and grinding. Cost 3 NELCO Cutters $93.00.
14112F	140.00	B	336.00	84.00*	Cost of Complete do-it-yourself cutter and two sets of replacement blades $504.00 + replacement and grinding. Cost 3 NELCO Cutters $420.00.
12206-1	50.50	C	116.00	40.48*	Cost of Complete do-it-yourself cutter and one set of replacement blades $156.80 + replacement and grinding. Cost of 2 NELCO Cutters $101.00.
10306-½	37.00	D	129.00	33.12*	Cost of Complete do-it-yourself cutter and three sets of replacement blades $228.36 + replacement and grinding. Cost of 4 NELCO Cutters $148.00.
10108F	86.00	E	292.00	102.58*	Cost of Complete do-it-yourself cutter and four sets of replacement blades $702.32 + replacement and grinding. Cost of 5 NELCO Cutters $430.00.

*Figures above do not include removing old blades, inserting new blades and grinding.

FIRST COST IS LAST COST with a NELCO one piece Carbide Tipped Cutter: No expensive downtime to remove, replace and regrind inserted blades. Every NELCO cutter is ready to use-without delay . . . without added "hidden costs!" A spare NELCO cutter costs far less in every way!

Send today for the New Nelco Catalog showing over 700 carbide tipped cutting tools.

NELCO TOOLS

For that EXTRA Edge in Production!

Nelco Tool Co., Inc. • Manchester, Conn.

on work requirements. Work measurement standards (hours required — determined from basic standard data or estimates) should be developed to cover all types of maintenance work. The extent to which scientific time analysis is utilized depends upon the practicability and characteristics of the work.

It is highly important to consider equipment analysis. Make periodic reviews of equipment repair cost history. These will pinpoint:

1. High-cost repetitive jobs.
2. Requirement for redesign of elements of any item of equipment.
3. Need for replacing equipment where maintenance costs are excessive.
4. A guide for selecting replacement equipment.

Training of personnel is essential. To a large degree, the success of any maintenance control plan depends upon effective supervision and complete understanding on the part of all plant people concerned. The confidence, enthusiasm, and cooperation of maintenance supervisors, mechanics, operating supervisors and other plant personnel depends upon the method of presentation of the facts relating to the program.

And, last, I must point out the utmost of importance in keeping your foreman on your side.

It is appalling to learn, in this day of enlightened labor-management relations, that in many companies the foreman is still the forgotten man. He is neglected salary-wise and communication-wise.

To the rank and file employee, the foreman is the company. Employee morale depends largely on foreman morale. This is an elementary management axiom. Yet, in many companies we find that a little overtime will give an employee a bigger pay check than his foreman. And we find union shop stewards better informed on company plans than the foremen. They can tell the rank and file employee what's cooking, before the foremen themselves know.

All this leads to very poor company morale. The foremen resent their neglect by top management; and the employees lose their respect for the foremen.

Smart management makes certain that the foreman is top man in his department. He is kept informed on all company plans . . . by weekly meetings, foreman bulletins, or some such method. He knows what is going on before anyone else in the plant.

Moreover, smart management solicits the foreman's aid and advice when formulating plans that affect his department. After all, the foreman knows better than anyone else what can and cannot be done for the most efficient operation of his bailiwick. He can often prevent man-

CIRCLE INFORM-A-GRAM KEY NO. 36

Buy the one tube steel with the longest tube life per dollar: *Ask the experts!*

THE Timken Company makes 23 different high-temperature tube steels to help you solve your heat, pressure, corrosion and oxidation problems. But only *one* analysis really fits your particular needs, gives you maximum tube life per dollar—your best life/cost ratio. To find this *one,* right analysis, *ask the experts!*

Timken Company metallurgists are recognized authorities on high-temperature steels. They have over 20 years of experience backing them up. They'll put this experience to work for you, study your specific requirements, recommend the *one* tube steel that fits them—most economically.

You can be sure, too, that the analysis of Timken® steel you get will have uniform high quality. Because the Timken Company makes its own fine alloy electric furnace steels, it can maintain rigid quality control from melt shop through final inspection.

Timken Company metallurgists will be glad to help you solve your tube steel problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

This month's report is on:

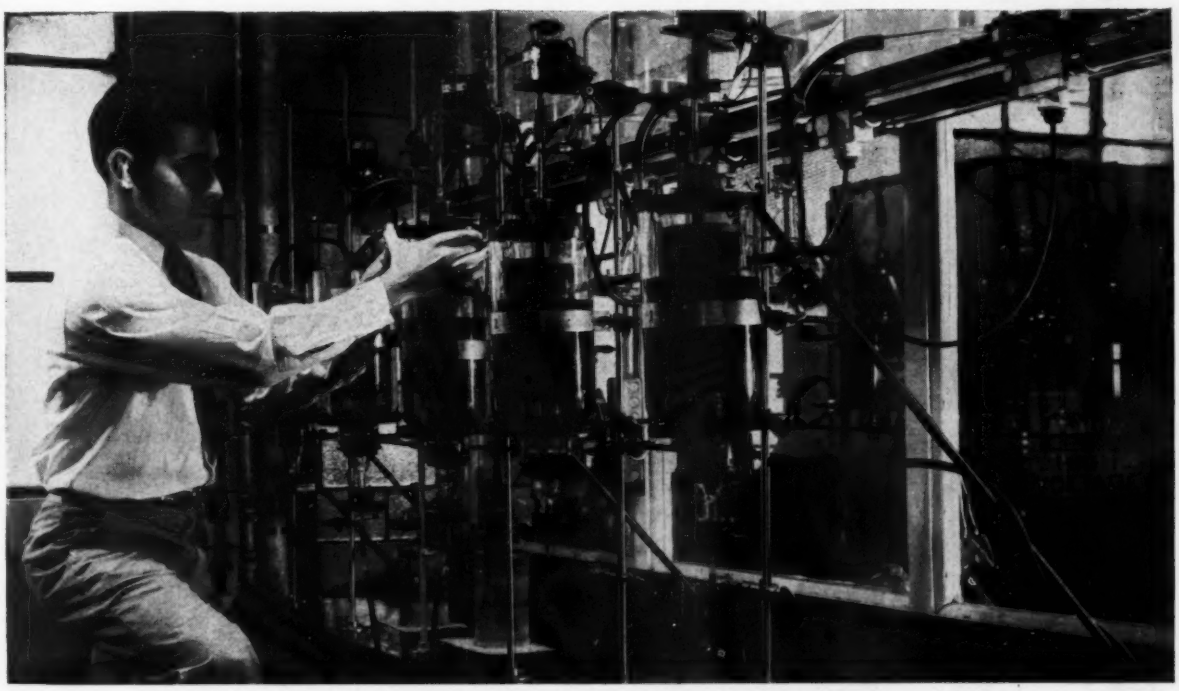
DM STEEL

Has unusually high creep strength for a pearlitic steel, good stability up to 1200°F., fairly good corrosion and oxidation resistance. Has 2 to 3 times the life of carbon steel where corrosion is not severe. Recommended for cracking furnace tubes, hot oil lines, superheater tubes, high temperature steam piping and forgings for accessory parts.

23 TIMKEN STEELS FOR HIGH TEMPERATURE SERVICE

Carbon	Sicromo 2	Sicromo 5S	16-13-3
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	25-20
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-12
Silmo	Sicromo 3	Sicromo 9M	35-15*
DM	4-6% Cr.-Mo.	18-8 Stainless	16-25-6*
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	

*Not available as seamless tubing at the present time.



Special electrolytic extraction equipment helps separate inclusions, to give steel maximum cleanliness.

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U. S. PAT. OFF.

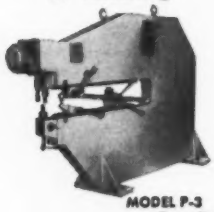
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

CIRCLE INFORM-A-GRAM KEY NO. 37

Here's Why PULLMAX is called the world's most *Versatile* SHEARING AND FORMING MACHINE

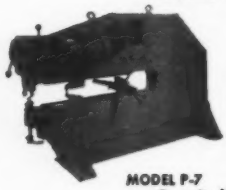
In addition to the operations shown, the Pullmax can perform the following operations:

- ★ Dishing
- ★ Edge Bending
- ★ Flanging
- ★ Nibbling

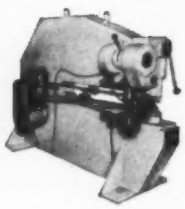


MODEL P-3
Capacity ½"

MODEL P-5
Capacity ⅞"

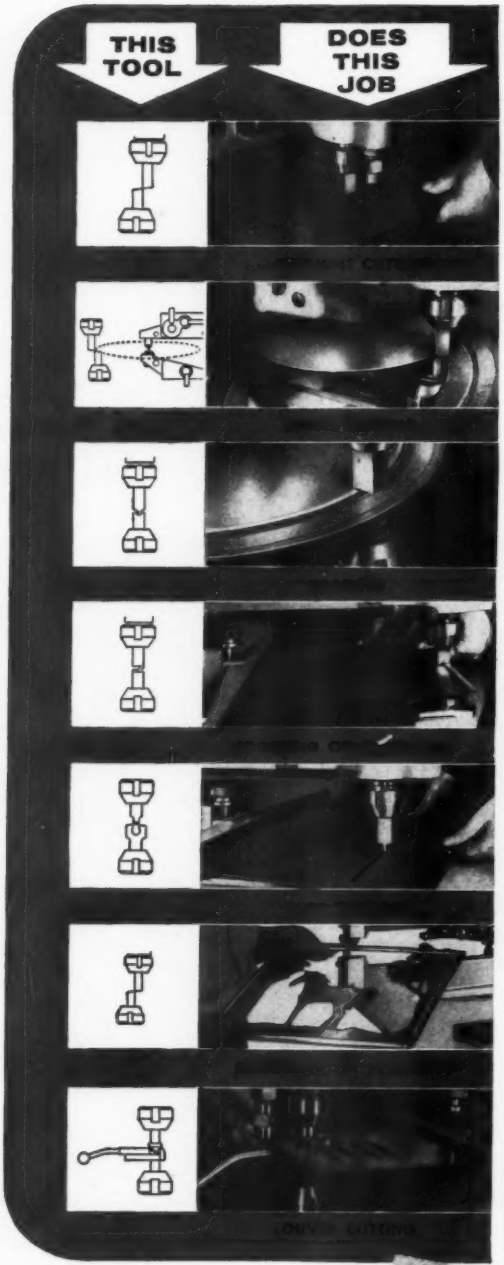


MODEL P-7
Capacity ½"



MODEL P-9
Capacity 1½"

TRIMMER-3
Capacity ½"



Write for this FREE booklet on Money Saving Metal Working ideas

AMERICAN PULLMAX COMPANY, INC.
2469 North Sheffield Avenue • Chicago 14, Illinois

"See us at the 5th Annual All-Welding Show, Convention Hall, Philadelphia, Pa., April 9-12. Booth 500."

CIRCLE INFORM-A-GRAM KEY NO. 38

agement from making serious mistakes.

And above all, smart management makes certain that its foremen receive adequate salaries . . . well above anything the employees under them might earn. The foremen are respected as an important part of management.

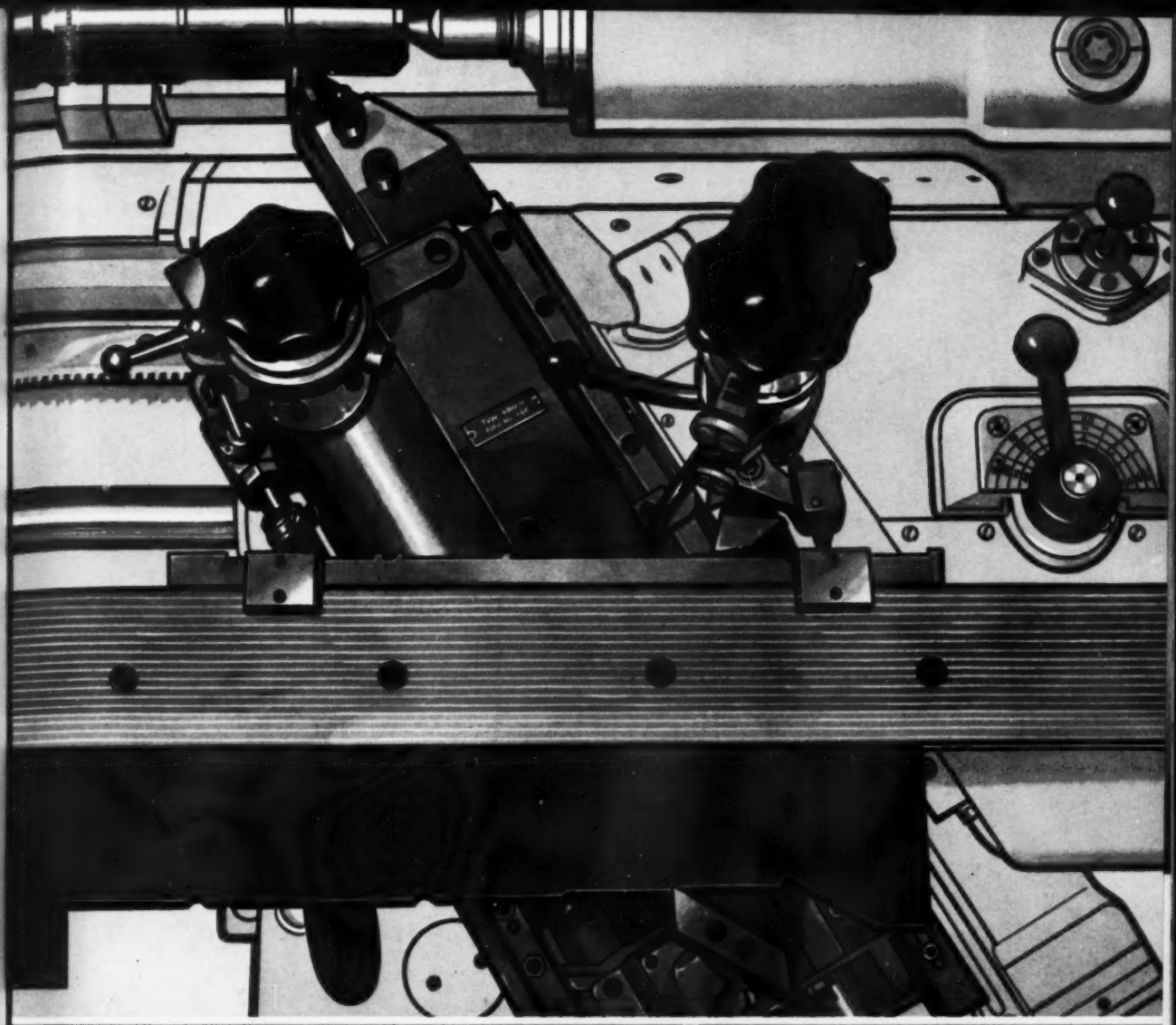
All this leads to a smoother running organization, better employee morale and an atmosphere conducive to profitable operation. end

IRON HAND REDUCES ACCIDENT HAZARDS AND LOWERS COSTS

A reduction in accident hazards was the direct result of a recent Sahlin Iron Hand installation at Whirlpool-Seeger Corporation's Clyde Division at Clyde, Ohio. In addition, the company was able to lower unit costs by transferring one man to other work.

Mounted on an 1850-ton hydraulic press, the Iron Hand first lifts the cylindrical basket to clear its die, and, as shown, swings it out of the press onto a conveyor. The jaw assembly, which was specially designed for this application, grips the basket on the flange. Deep drawn to 16" from 18-gage steel, the baskets weigh 30 lbs and are 21" in dia. Unloading speeds range up to 200/hr, depending on press speeds.

Synchronized with the press by means of a rotary limit switch, the Iron Hand, built by Sahlin Engineering Company, Inc., Birmingham, Mich., does not depend on the press for power, but is operated independently through its own air system.



New Britain +GF+ outproduces multi-tool lathes with a single tool

How can one tool outproduce several? The answer is — maintain dimensional relationships with a template or prototype instead of a multi-tool setup. This cuts tool changeover time to practically zero.

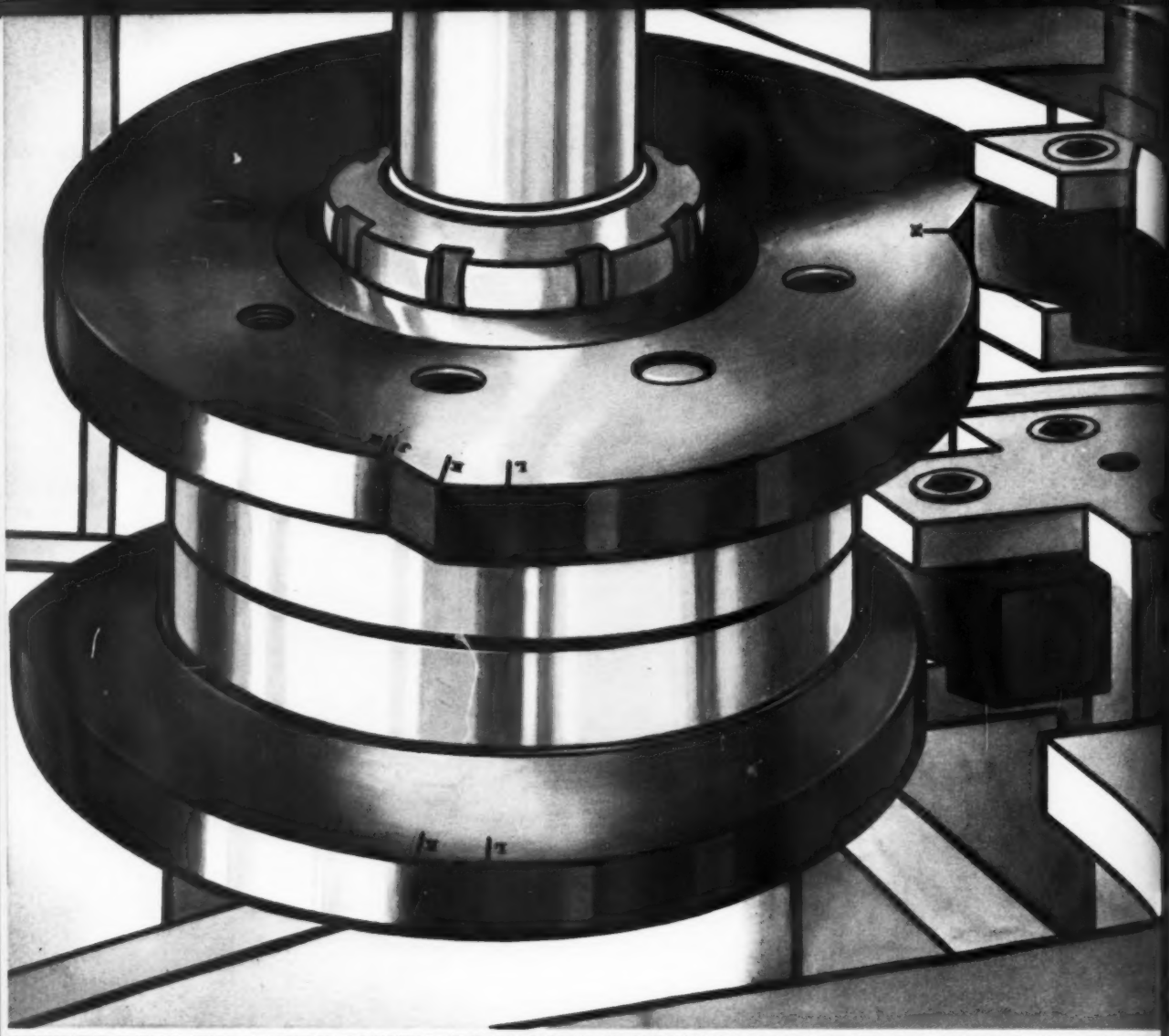
On the New Britain **+GF+** copying lathe, you can cut at maximum speeds and feeds for tool efficiency without worrying about tool wear and the delicate readjustment of several cutting tools. When the tool wears, change it, bring one dimension to size. The other dimensions have to be right. Your choice of a New Britain **+GF+** means elimination of any extra operation to bring pieces within grinding tolerances.

Machines from New Britain's three machine tool divisions incorporate the *basic principles* of more profitable production.

THE NEW BRITAIN MACHINE CO.

New Britain **+GF+**
Copying Lathe

NB

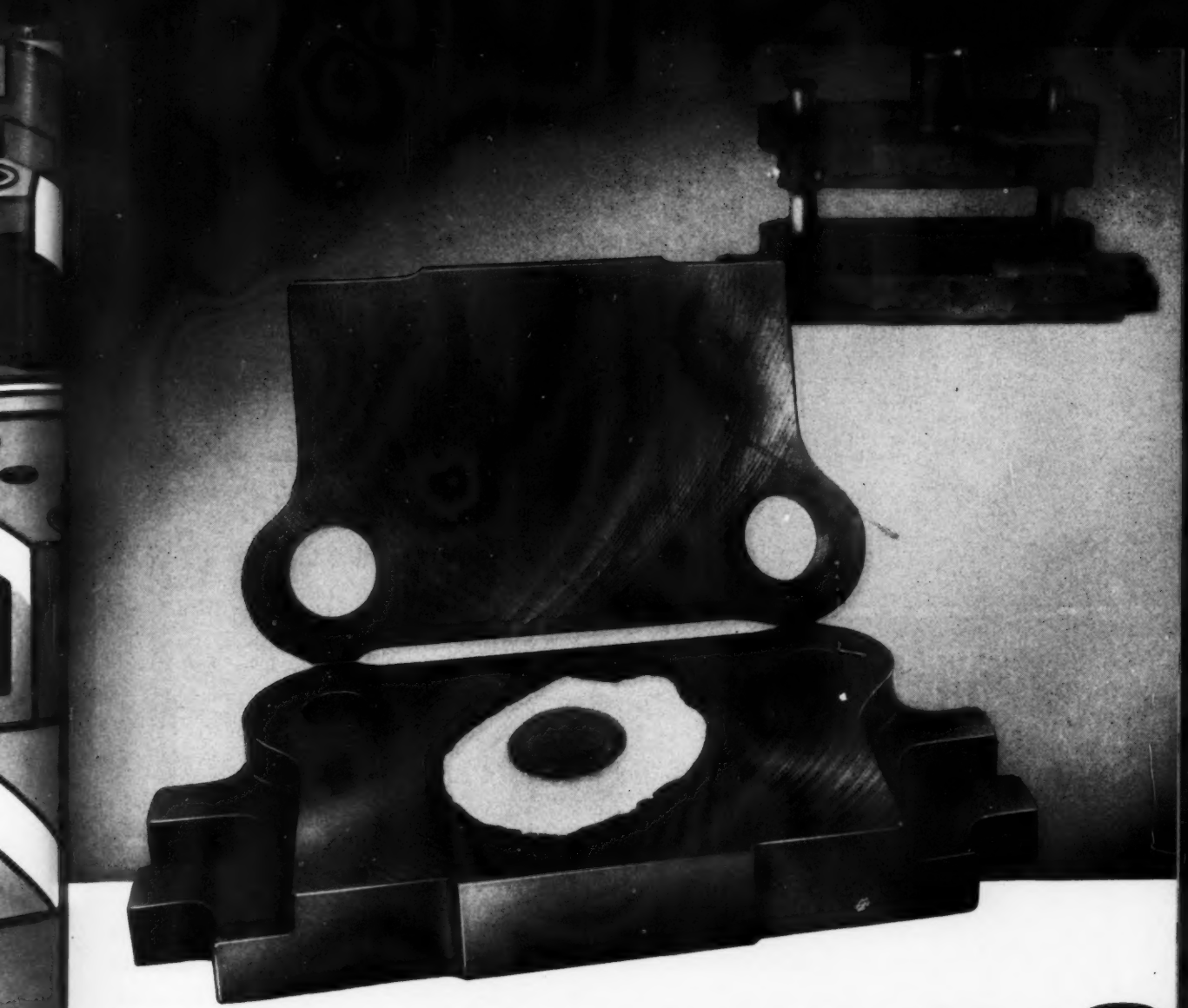


cams put the precision in precision boring

When you are working to "tenths" cams are your best method of maintaining accuracy, because cam control of the tool is *positive* control. The accuracy of parts produced on New Britain boring machines *can't* be affected by variable hydraulic pressures, ambient temperature, or play in complicated linkages.

In boring machines or *any* machine tool investment, be sure your most important requirements are met, not by gadgets, but by the fundamental design principles employed. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.
Precision Boring Machine
NB



WHAT'S COOKING ON DIE SETS?

The egg you've laid, brother, if the job isn't right.

Whether you're the tool engineer or the diemaker, once the die's in the line it has to produce or you've had it. And today it has to produce hundreds of thousands, even millions, of parts to pay for itself.

Obviously the die set is no place to cut corners. It's not only the heart of the die but frequently it's the least expensive part of the die anyway. A few dollars saved here won't go very far spread out over the life of the die, and it can prove costly.

Making quality die sets is our business. Quality means precision and stamina:

Precision for fast, accurate diemaking and lasting production accuracy.

Stamina to assure long, trouble-free operation in the line.

For your convenience, Detroit Die Set stocks over 2000 standard die sets. Our new catalog covers them all, plus details on specials, too. Ask for your copy on your company letterhead today.

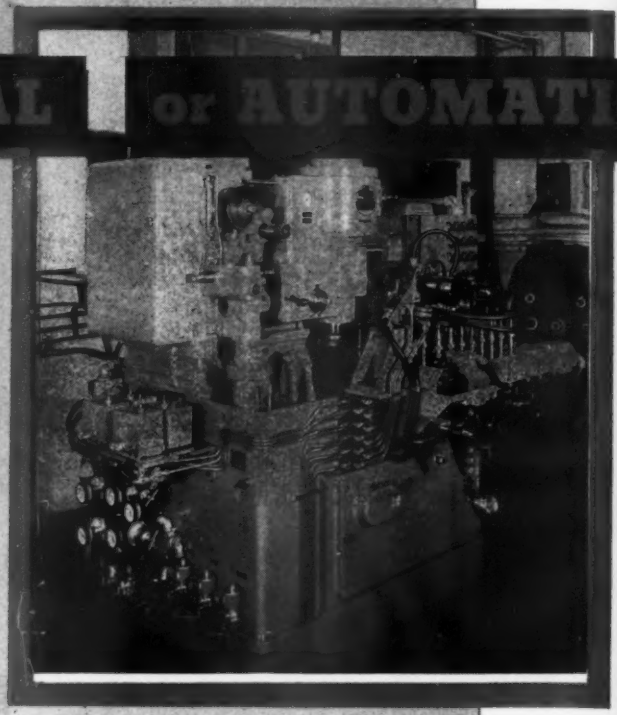
OFFICES IN PRINCIPAL INDUSTRIAL CENTERS

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.

VERSATILE

MANUAL or AUTOMATI



Practically any shaped part in its size range can be cut faster and more accurately on a Fellows No. 4GS Gear Shaper . . . with either manual, semi-automatic or full-automatic operation, depending on your needs!

This production flexibility makes the powerful "4GS" ideal for long runs on similar parts or for short runs of varied jobs. Set-ups are easy and fast. Internal or external spur and helical gears, as well as splines, cams and other irregular non-involute shapes up to 6" P.D. and 2" face width can be cut on this machine. Nine cutter speeds range from 98 to 635 strokes per minute.

The versatility of Fellows No. 4GS Gear Shaper, with manual operation or any degree of automation, can very probably lower *your* cutting costs. Ask your Fellows Representative to show you facts and figures. Write, wire or phone any Fellows office.

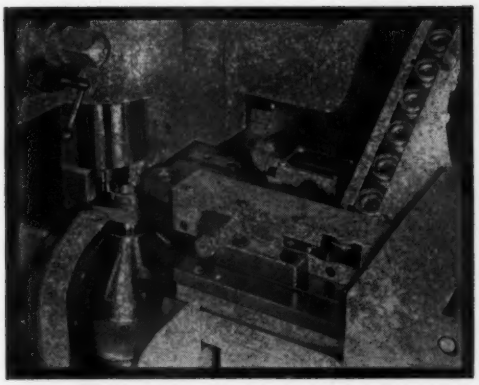
THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N.J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE

FELLOWS "4GS"

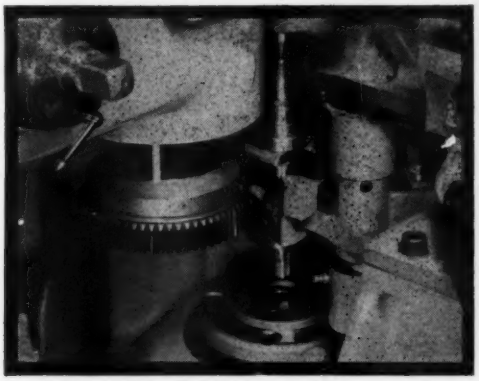
...or anything in between!

Helical gear cut on a motor crankshaft. Operation can be manual or semi-automatic. Part is held in a bushing at the bottom, an air operated split sleeve support at the top and driven from the connecting rod bearing surface.



Internal clutch parts produced with fully automatic loading and unloading. Part is transferred from loading chute to air operated expanding arbor and teeth are cut. Part is then removed from arbor and transferred to unloading chute while another blank is being loaded.

Two cams and a gear are cut at the same time on this gasoline motor part. Cutters are used in tandem and are keyed together to give the required relation between the positions of the cams and the teeth of the concentric gear. Operation is manual.



Automotive transmission cluster gear shaft handled automatically. Air operated "fingers" move shaft into position for automatic chucking and then place finished part in unloading conveyor.

Fellows *Gear Production Equipment*

CIRCLE INFORM-A-GRAM KEY NO. 43

new electro-ground carbide end mills

manufactured by **ELGIN**

Elgin GOLDEN CIRCLE Carbide End Mills . . . solid carbide, of course, for the toughest jobs. But most important, Elgin Golden Circle End Mills are ground by Elgin's new Electro-Grind process which completely eliminates the strains and grinding checks caused by conventional methods. No chance for chipped or flaked cutting edges caused by high temperatures during grinding!

Electro-Grind combined with the use of extra fine grit wheels gives the sharpest, smoothest cutting edges yet—your assurance of the highest quality tools obtainable, increased production, less frequent regrinding, greater accuracy.

Write for new catalog showing complete line of solid carbide end mills, drills, reamers and burs—in stock for immediate delivery.

Abrasives Division

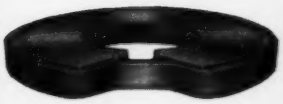
ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS

NOW

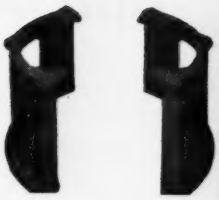
BUILD YOUR OWN PRODUCTION MACHINES WITH HARTFORD "OFF-THE-SHELF" COMPONENTS

Columns



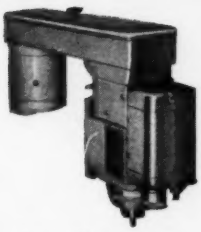
Circular Base Top

Index Table Support

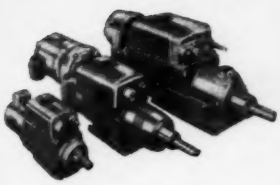


Pedestals

Unit Mounting Adapters

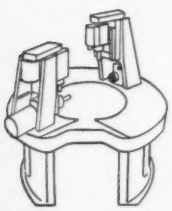


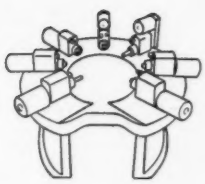
Integral Motor Mounts



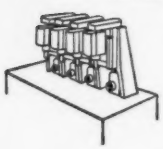
Automatic Air-Hydraulic Drill Units

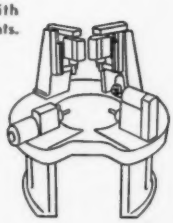
Automatic Cam Type Drill Units





Four of the many machine setups possible with Hartford Components.





HARTFORD SPECIAL now offers a complete high production automatic processing machine in knock-down form, ready for assembly on your floor. The production-tested components and elements illustrated above are available *from stock*, and are the same standard machine equipment from which Hartford's line of complete automatic drilling and tapping machinery is made.

For the plant that is plagued by model changes or setup costs, these preengineered components can offer unlimited time and cost saving. "Building block" construction allows you to build a production machine to your own design or needs on the spot, when and where you need it. Call in Hartford now, and take advantage of our offer to produce better products at lower cost through better methods.

HARTFORD *Special*

Hartford also makes automatic Thread Rolling Machines, Special Machinery and the world famous Super-Spacer.

Machine Tool Division
THE HARTFORD SPECIAL MACHINERY CO.
2924 Homestead Ave., Hartford, Conn.

Send me data sheets and complete information on your "off-the-shelf" components.

Name_____

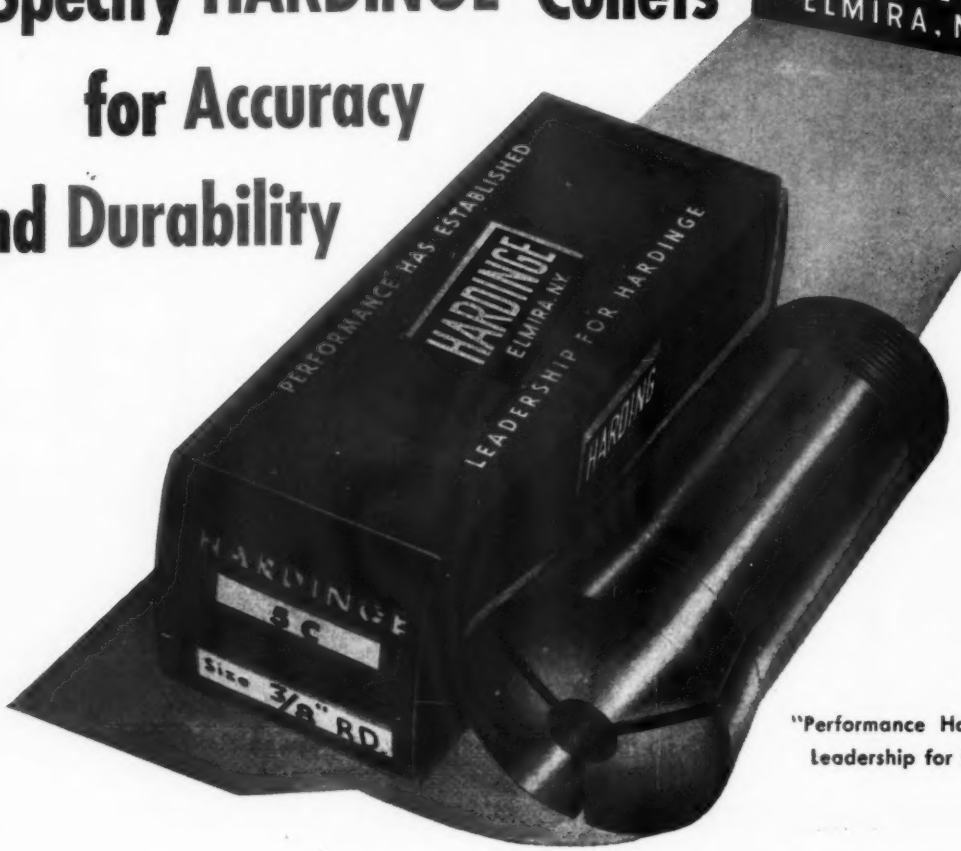
Company_____

Street_____

City_____ Zone____ State____

Specify HARDINGE Collets for Accuracy and Durability

HARDINGE
ELMIRA, N.Y.



"Performance Has Established Leadership for HARDINGE"

For Your LATHES and MILLING MACHINES

HARDINGE Draw-in Collets symbolize accuracy, long life, and low cost because they are hardened and ground both internally and externally, have heat treated threads, — and cost no more than ordinary collets.

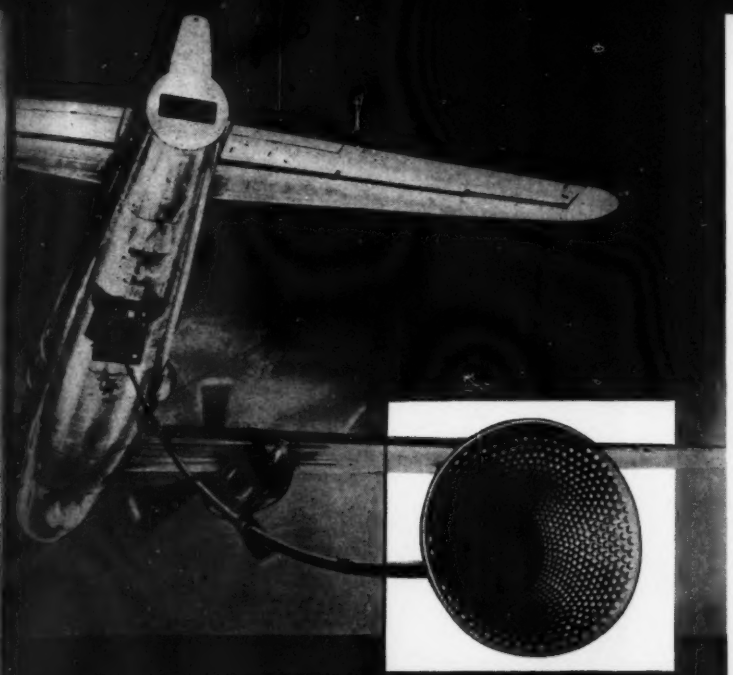
HARDINGE Collets assure you of all-essential accuracy plus durability and economy.

Write for Bulletin 56 — complete collet ordering information for all Lathes and Millers.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

CIRCLE INFORM-A-GRAM KEY NO. 46



FLYING GAS STATION! Dragues for refueling aircraft in flight show how Araldite Epoxy-glass cloth laminates combine high strength weight ratios with excellent chemical resistance.

Hampden Brass & Aluminum Co.
Flight Refueling Co., Inc.

ARMOR FOR BOATS! Here an Araldite Epoxy formulation is used with glass cloth for the armor plating of small boats. The same combination can be used for the rapid, inexpensive repair of splits and gouges in boat hulls.

Cordo Chemical Corporation

CIBA's Technical Services, including complete and up-to-date bulletins on the properties and uses of Araldite Epoxy Resins are always available for the solution of your Epoxy-problems. For full information, mail coupon or write.

CIBA produces basic resins only, to be formulated for intermediate and end uses

from gas stations in the sky... to armor for small boats...

LAMINATING WITH ARALDITE® EPOXIES SPEEDS UP PRODUCTION.

EASILY PROTOTYPED... LOW COST MOLDS... FAST CURING!

Is your problem the production of prototypes for design approval? Is it mass production laminates . . . is it custom work? Whatever the problem, Araldite Epoxies may help you.

Their unique combination of extremely low shrinkage (from less than 0.5% to 2%), dimensional stability, rapid curing (in minutes with heat), and excellent adhesion, are providing answers daily to design and production needs.

Molds, too, can be made inexpensively from wood, plaster or metal.

Or if your interests are tooling, electrical, adhesives or coatings, it would pay you to investigate Araldite Epoxies.

Why not now? The coupon is for your convenience.

CIBA

"FIRST IN EPOXIES"

CIBA COMPANY INC., Plastics Division
Kimberton, Pennsylvania

T & P-4

Please send me full information on CIBA Epoxy Resins for

- ☐ Tooling
- ☐ Electrical
- ☐ Structural Laminates
- ☐ Hi-Strength Adhesives
- ☐ General
- ☐ Surface Coatings
- ☐ Plastic Body Solders

NAME _____

COMPANY _____ TITLE _____

ADDRESS _____

CITY _____ STATE _____

Self-locking UNBRAKO socket screws keep critical adjustments secure in the eccentric drive mechanism of this fatigue testing machine. Drive system delivers varying loads up to 15,000 pounds force to equipment under test at 1050 cycles per minute.

Vibration won't loosen Self-locking UNBRAKO socket cap screws

Screws with Nylok* device permit adjustments, keep precise settings during long test runs

HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together, and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok self-locking device stay tight under constant vibration.

Take the eccentric drive system in the fatigue testing machine illustrated above, for example. This machine must frequently run for periods up to 2 weeks or longer, day and night, to complete a single test. Loosening of the screws which are used to adjust the tension-setting mechanism could not only cause damage to the machine, but also make the test data worthless. Self-locking UNBRAKO socket head cap screws eliminate such problems.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or pounding, or endless running of a machine, won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives complete catalog and technical data on the entire line of UNBRAKO socket screws with the Nylok self-locking device. Or see your authorized industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 36, Pa.

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

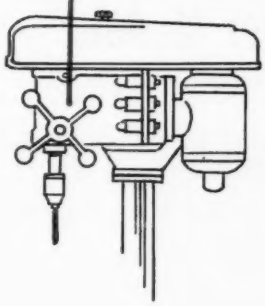
SPS

JENKINTOWN PENNSYLVANIA

*T.M. Reg. U.S. Pat. Off. The Nylok Corporation

CIRCLE INFORM-A-GRAM KEY NO. 48

LET'S *Automate* A DRILL PRESS



Like to know more about it?

These two free booklets tell the entire story. Write for them today. Address: Dept. TP-457, The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

There are more hand fed drill presses in use than any other machine tool. They are all pretty much alike. The operator positions the work in a jig or fixture, feeds the drill in and out of the work by turning a star wheel by hand, and removes the work from the jig.

A good workman can drill a clean hole. But not too many of them. It's a tiring job. Towards the end of the shift both quality and quantity suffer.

Let's put a Bellows Drill Press Feed on the star wheel shaft. Now, the operator touches a lever. Automatically the drill is fed in and out of the work, under perfect control. Production is increased 20%-30%; quality is better; tool life longer.

Let's go a step farther. Add a Bellows Rotary Feed Table. Now all the operator has to do is load parts. The table automatically positions the part under the drill. the drill press feed automatically feeds the tool, the table indexes to eject one part and position another. Production is more than doubled, often more than tripled.

How much does such a set-up cost? Roughly five weeks wages of an operator buys it. Actually it costs nothing. It pays for itself, often with the first week's cost savings.

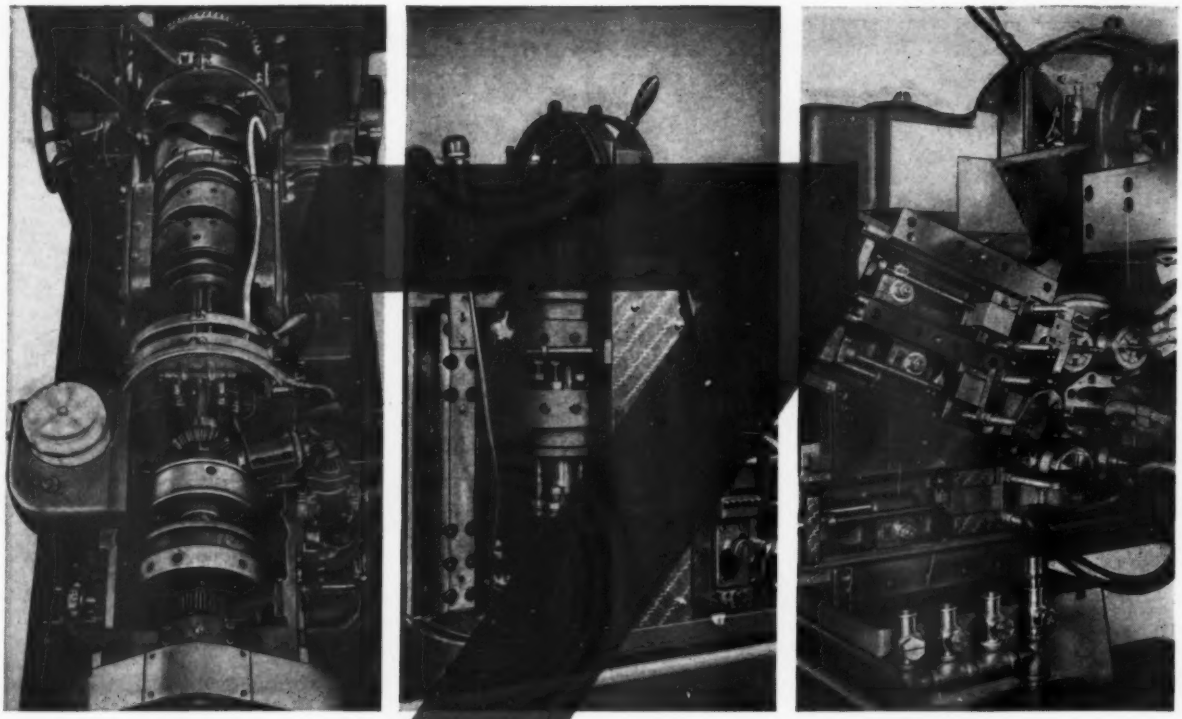
The Bellows Co.

AKRON 9, OHIO

MANUFACTURERS OF CONTROLLED-AIR-POWER DEVICES FOR FASTER, SAFER, BETTER AND **LOWER-COST** PRODUCTION

7678

CIRCLE INFORM-A-GRAM KEY NO. 49

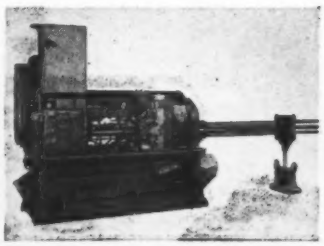


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1⅝" Sixes, and the 2⅝", 3½", 5", and 5¼" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

CIRCLE INFORM-A-GRAM KEY NO. 50

INCREASE PROFIT MARGIN ON FORMED STAMPINGS WITH U. S. MULTI-SLIDES®

Reduce your costs and increase your profit potential! Elimination of secondary operations and handlings result in reduced costs. It is therefore important to produce parts, wherever possible, complete in one machine. The U. S. Multi-Slide, through a combination of built-in motions, allows for the designing of tools to fabricate precision formed metal stampings without secondary handlings.

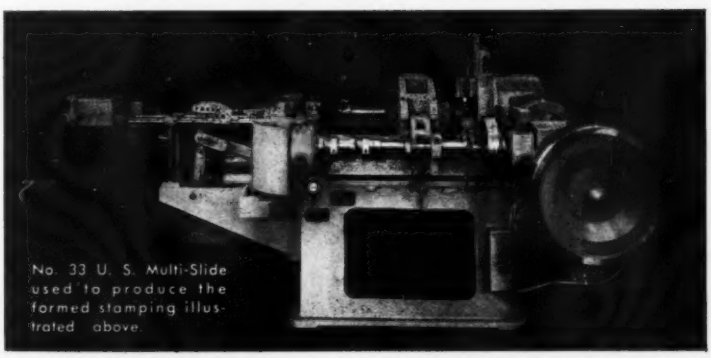
Standard equipment on the machine includes: ram action for cutting, piercing, trimming, embossing, etc.; a four-slide forming position, and a vertical movement for stripping and transferring. Since these movements are part of the machine equipment, it is not necessary to incorporate complicated movements into the dies themselves. The machines are built in four sizes, and on the three larger units it is possible to use two or more rams simultaneously, as illustrated in the sequence of operations drawing below.

Investigate. Ask for a copy of our Bulletin 15-P or send us part drawings or samples for our recommendations.

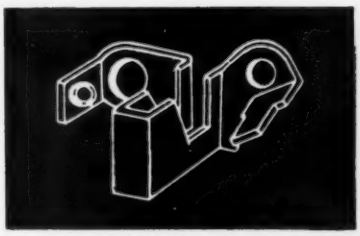
U. S. TOOL COMPANY, INC.

Ampere (East Orange) New Jersey

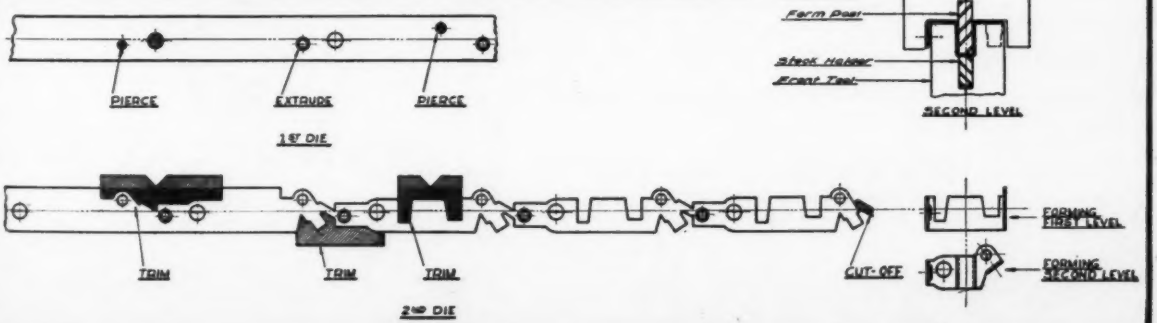
Builders of U. S. Multi-Slides — U. S. Multi-Millers — U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories



No. 33 U. S. Multi-Slide used to produce the formed stamping illustrated above.

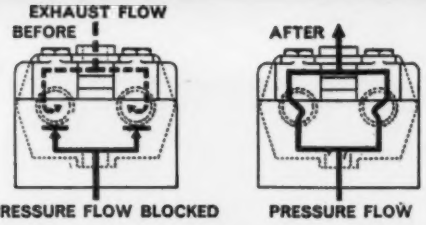


The automotive component shown above is produced complete, without secondary operations, in the No. 33 U. S. Multi-Slide Machine. Drawings below indicate the sequence of stages in the dies and forming positions. Observe the two-level forming position used to complete the piece after cutting off.



CIRCLE INFORM-A-GRAM KEY NO. 51

... make tracks
TO YOUR
Threadwell
DISTRIBUTOR
FOR THE FINEST IN
CUTTING TOOLS AND GAGES
Made by THREADWELL, Greenfield, Mass.



ACTUALLY TWO MASTER VALVES IN ONE—interlocked pneumatically with common inlet and outlet ports. Diagrams show pressure flow *before* and *after* solenoids are energized. For double safety, solenoid control keeps press from starting—or will cause it to stop "safe"—unless both valves work simultaneously.

No. 4—Air Clutch Press, Flywheel-type

This double-solenoid safety valve makes

FEDERAL air clutch presses DOUBLY SAFE

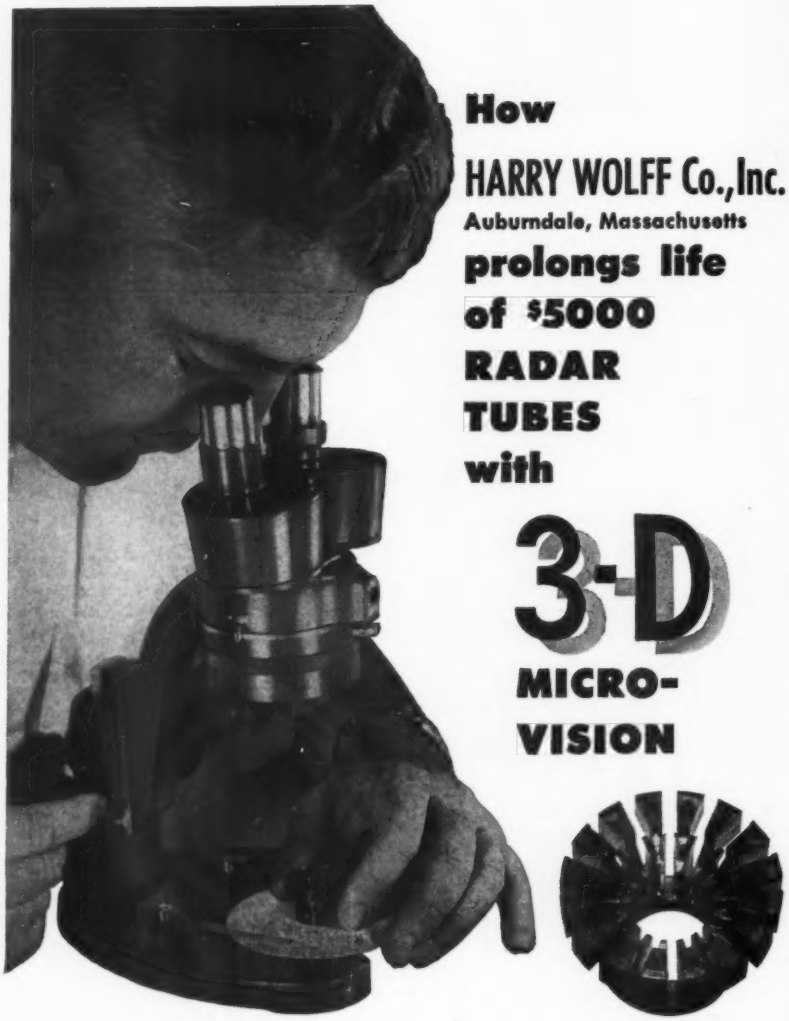
Puts new GO in presswork!

Here is the answer to faster, safer, more economical production: the new Federal Air Clutch Press with double-solenoid control. Speeds may be increased without damage to work, without sacrificing precision. For the dual control gives you the protection you want—makes "repeats" due to valve failure *practically impossible.* Also operation is simpler—less fatiguing. Press may be "inched", single-tripped, or operated continuously. Available in sizes 6 to 100 tons. Prompt delivery on all models. *Write for new catalog showing complete line.*

FEDERAL PRESS COMPANY
707 Division Street, Elkhart, Indiana

FEDERAL Open Back Inclinable PRESSES

32 Years of Quality Construction



How
HARRY WOLFF Co., Inc.
Auburndale, Massachusetts
prolongs life of $5000 RADAR TUBES with
3-D MICRO-VISION

A tiny burr on this tuning crown will burn off at normal operating temperatures and cause radar tube failure. Precision components like this are made of metals that cost over $100 per pound. The tube costs up to $5000. Obviously, rejects and failures are prohibitively costly.

That's why Harry Wolff Co., Inc., uses Bausch & Lomb Stereomicroscopes to check 368 different edges of each tuning crown. Inspectors see the work right-side-up, clearly magnified in vivid 3-dimensional detail. Burrs are quickly revealed, and easily scraped off.

And that's why Harry Wolff, president, says: "We consider the B&L Wide Field Stereomicroscope as important to us as a precision lathe."

FREE! GET THIS EXCLUSIVE 3-D MICRO-VISION BOOK

BAUSCH & LOMB

America's only complete optical source... from glass to finished product.

See actual stereo views! Know *how* and *where* to use Stereomicroscopes. Choose exact model for job needs, with unique Selector-Chart. Write today for Manual D-15. Bausch & Lomb Optical Co., 77316 St. Paul St., Rochester 2, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 54

At Your SERVICE

Experimental and production brazing and processing of stainless steel are handled by the Stainless Processing Division of Wall Colmonoy Corp., Detroit. The company makes available up-to-date facilities and skills to users of parts fabricated of stainless steel, titanium and special alloys. Its furnaces are capable of receiving workpieces up to 72" high by 70" in dia. Low carbon coil steel annealing is also done by this division.

To round out its heat treating facilities, Standard Steel Treating Co., a major Detroit area specialty heat treat concern, has purchased Steel Treat, Inc. This firm is a complete production heat treating plant which will be operated as Standard Steel Treating Co., Plant No. 2. The new facility, with 17,000 sq ft of floor space, houses four distinct heat treating lines. Total daily capacity exceeds 100,000 lbs. Custom heat treating, requiring special processes or specifications, will continue to be handled at Standard Steel Treating Co., Plant No. 1.

Gries Reproducer Corp., New Rochelle, N. Y., on fully automatic machinery, can produce a miniature jack-knife, for example, in a single die-casting cycle. The machinery produces the knife and other Intercast miniatures cast-assembled, trims off gates and sprues and ejects ready-to-ship units. The Intercast process is also used to make swivel rings, binder rings and sister hooks.

A specialized high speed steel forging service for tool, die and special machine makers has been announced by Smith-Armstrong Forge, Inc. of Cleveland. High speed steel is forged to exact customer specifications in flats, rounds, rings, bushings, etc. The company also supplies a rough and finish machining service, if specified.

Various sheet metal fabrication and industrial finishing services are made available by Nostrand Metal Fabricators Corp., Brooklyn, N. Y. The company assists in the design of products and in the alteration and modification of existing assemblies and parts. Complete facilities are provided for close tolerance fabrication in all gauge metals up to ¼".

Quick Industries, Inc. of Jackson, Mich., has formed a new division, Quick Plastics, which specializes in the custom extrusion and fabrication of plastics. The division's new equipment enables it to produce top quality work to very close tolerances and assures uniform production of difficult sections. Fabrication at the plant consists of the assembly of extruded sections into complete units.

Buy BULLARD HYDRA-FEED

To Get The Best In Production Lathes

AUTOMATIC MULTIPLE TOOL OR TRACER CONTROLLED LATHES AVAILABLE IN FOUR SIZES

CHECK THESE FEATURES:

Unobstructed front design allows easier loading — quick tool change.

Massive strength and rigidity with extra power to take full advantage of maximum feeds and speeds.

Hydraulically operated slides may be set to automatically perform any combination or sequence of operations.

For complete details send coupon for catalog *TODAY!*

THE BULLARD COMPANY
286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT

Please send me a copy of the

NEW BULLARD HYDRA-FEED LATHE CATALOG

NAME _____

COMPANY _____ POSITION _____

ADDRESS _____

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The world's most accurate

Now distributed in the United States and Canada by Jacobs and your Jacobs chuck distributors

The Albrecht Heavy Duty Drill Chuck

- Keyless construction
- Excellent gripping power
- Self tightening — smooth release
- Very high accuracy
- Drill breakage minimized
- For tool room and the production line

The Albrecht Heavy Duty Drill Chuck is available in 11 taper back models in capacities up to 5/8". This is a keyless, self-tightening chuck of exacting accuracy.

The Albrecht Small Drill Chuck Model No. 15 JO

Model 15 JO is especially designed for small diameter drills. It has a maximum capacity of 1/16" and a minimum well under the No. 80 drill. Like the heavy duty models, No. 15 JO is keyless, and self tightening.

The superlative performance of this precision chuck is now available to you through your Jacobs industrial supply distributor. He is backed up by replacement parts stocked in the United States, plus the finest service facilities anywhere.

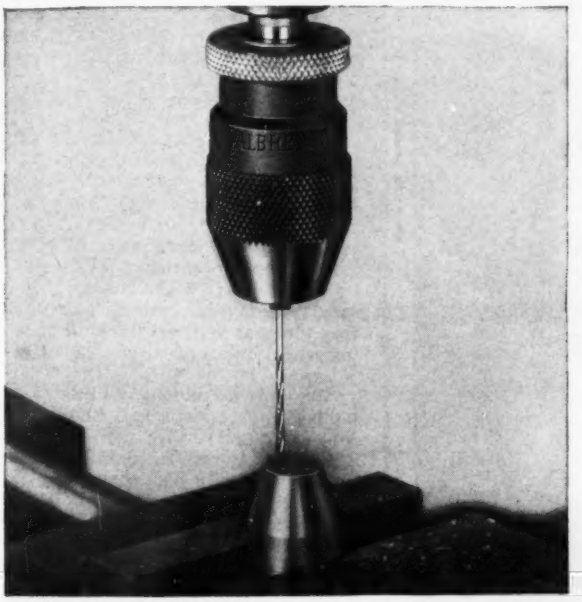
Call your Jacobs industrial supply distributor for full details and your copy of the new Albrecht catalog.

keyless drill chuck

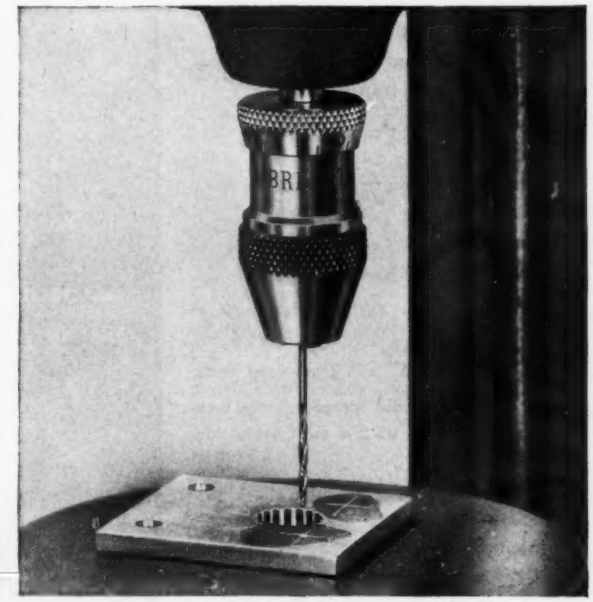
Close tolerance drilling easily accomplished on a tool room milling machine.

Get the finest performance from your jig borer with the world's most accurate keyless drill chuck.

Albrecht Chucks are ideal on milling machines and jig borers



The Albrecht Keyless Chuck is ideal for use on high speed sensitive drilling machines.



The Albrecht Small Chuck, Model 15 JO, is the finest keyless chuck available for accurate drilling of the smallest holes.

Close tolerance drilling on high speed drill presses

Jacobs CHUCKS

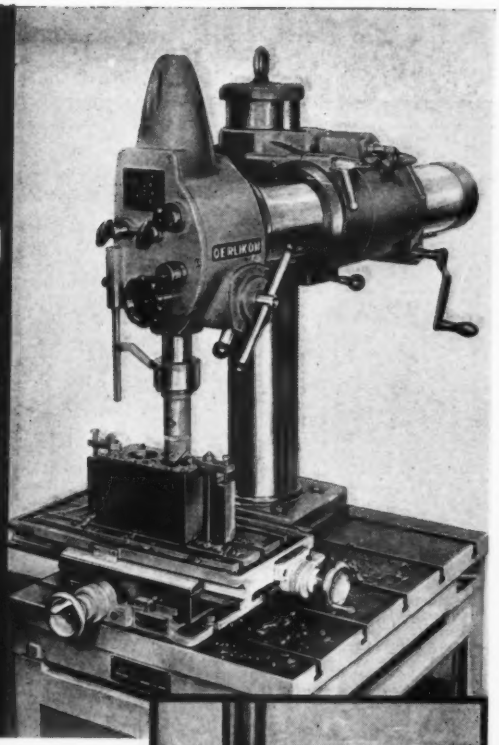
The Jacobs Manufacturing Co. • West Hartford, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 57

OERLIKON

UB 2

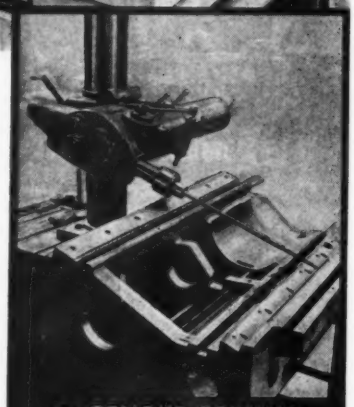
ALL ANGLE PRECISION BORER



The UB 2 performs hundreds of general and specialized workshop operations—drilling, milling, countersinking, tapping, precision and center boring, reaming, facing, trepanning, etc.

- Radial swivelling arm combined with a freely swivelling head, allows handling of any job—even in awkward positions.
- Boring head can be canted to any angle (360°) and latched accurately in the vertical and horizontal positions.
- Spindle speeds variable from 30 to 3070 rpm.
- Travel of quill 6" with 3 powered feeds.
- A compound table for coordinate location makes the UB 2 a most useful tool room machine.
- Accessories include precision chuck, tapping head, collets holder, adjustable boring head, facing and turning head, trepanning tool, boring bars, etc.
- Portable—take it right to the job.

Write for detailed information and prices to:



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MILLING OPERATION ▼

Mr. Frank Perret

c/o OLKON RESEARCH CORPORATION

630 Fifth Ave., New York 20, N. Y. • Tel.: Circle 6-0453

(Some exclusive territories still available)

Presenting . . . Representing . . .

Kenco Mfg. Co. has appointed Aaron Machinery Co. of Calif., Inc. as a franchised dealer in Los Angeles. Aaron will handle the complete line of Kenco presses, rotary tables and milling machine vises.

•

Zimmerman and Gaumond, Inc. in Park Ridge, Ill., has been named to represent Seneca Falls Machine Co. in Illinois, Iowa, southern Wisconsin, and the South Bend, Ind., areas.

•

Ram Chemicals, Inc., Gardena, Calif., is the new western sales and service representative for Marblette Corp.

•

The H. F. Black Equipment Co. has been incorporated under the name of Black & Coulton, Inc. The company is one of northeastern Ohio's leading distributors of material handling equipment.

•

Globe Machinery & Supply Co., Des Moines, Ia., has been appointed exclusive distributor for the Iowa area by Greaves Machine Tool Co., division of J. A. Fay & Egan Co. Greaves specializes in the manufacture of plain and universal milling machines, production machining, special machine tools and all types of gears.

•

Remco Supply Inc., Greensboro, N. C., has become an authorized Carboloy carbide tool distributor for the Metallurgical Products Department of General Electric Co. The organization supplies industries in the Winston-Salem, Greensboro, Durham and Raleigh areas with standard and special cemented carbide metal-cutting tools, as well as diamond grinding wheel dressers.

•

Augustin P. Sheehy will serve as industrial sales representative in the New England states for The Aro Equipment Corp. Headquartering in Boston, he will be responsible for sales of the company's industrial lubricating equipment and will set up a distributor organization.

•

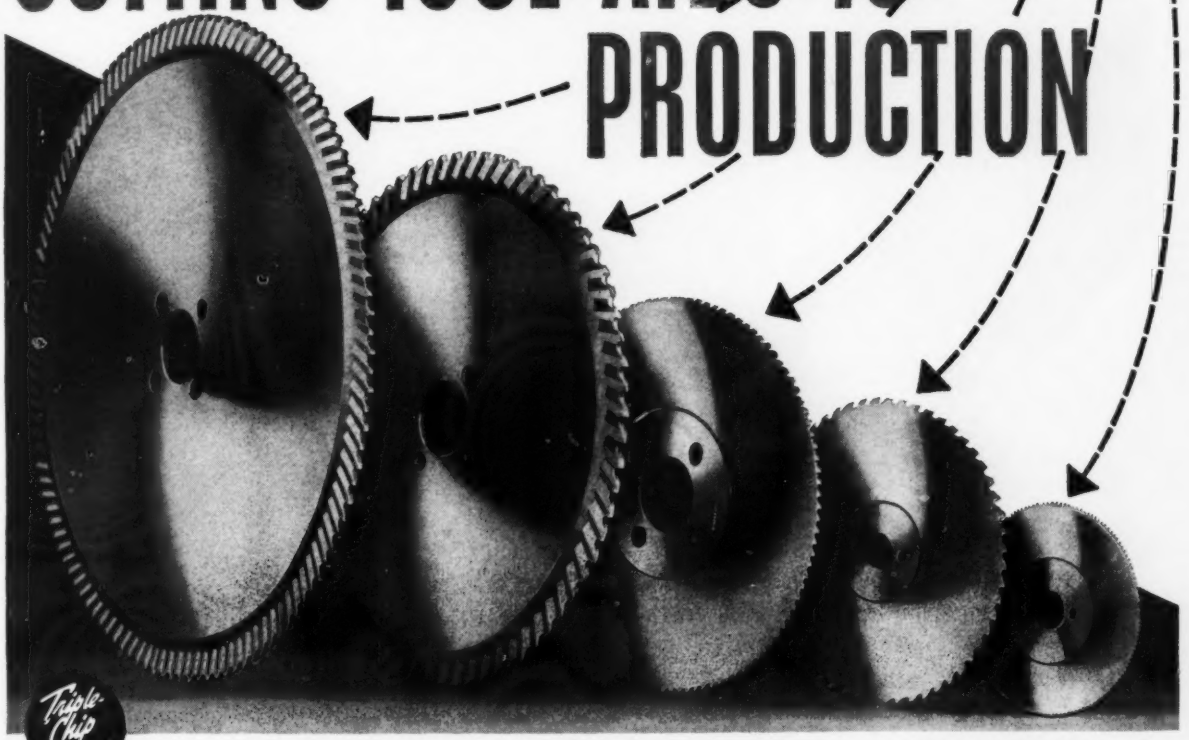
Schroeder Brothers Corp., Pittsburgh representative for air and hydraulic valves and cylinders produced by Rivett Lathe & Grinder, Inc., has moved to a new location in McKees Rocks, Pa.

•

The appointment of Hallidie Machinery Co. of Seattle, Wash., as technical sales and service representative has been announced by Speed-D-Burr Corp. Hallidie will cover Washington, Oregon, Idaho, Montana and the territory of Alaska.

The Motch & Merryweather Cutting Tool Manufacturing Division offers you

CUTTING TOOL AIDS TO PRODUCTION



SEGMENTAL TYPE **SOLID TYPE** **SLITTING SAWS**

GET the full story on Motch & Merryweather's complete line of saw blades and slitting-slotting saws—a type, size, and thickness for *every* purpose. Triple-Chip cut-off blades up to 108" diameter down to slitting saws 3" in diameter—special saws—for any machinable material, ferrous or non-ferrous, any size, any shape, any thickness.

Ask how the M & M Triple-Chip Method reduces tooth strains, prolongs blade life and speeds production with accuracy.

TRIPLE C®
GRINDING COOLANT
Clear—Cool—Clean

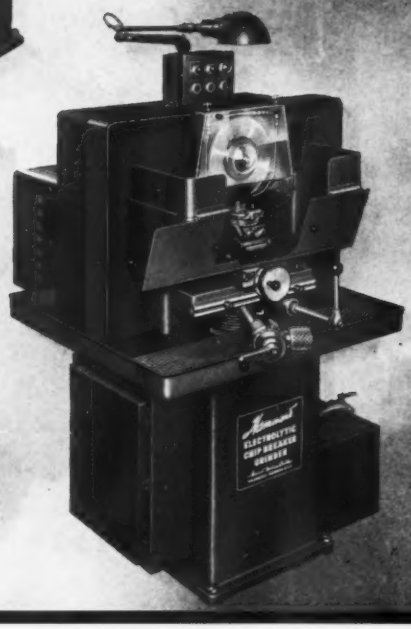
Triple C® grinding coolant makes for improved results and lower costs on all wet grinding. Transparent, stable solutions; maximum cooling; grinding wheels stay clean and free-cutting.

THE MOTCH & MERRYWEATHER MACHINERY CO.

CUTTING TOOL MANUFACTURING DIVISION
1250 East 222nd Street • Cleveland 17, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 59

DAWN OF A NEW ERA
for
CARBIDE TOOL and
CHIP BREAKER GRINDING



SPECIALLY DESIGNED
FOR THE
ELECTROLYTIC
PROCESS

Two COMPLETELY NEW Hammond UNITS that are making Grinding History!

The new Hammond Electrolytic *Oscillating* and Chip Breaker Grinders were designed primarily for use with the Anocut electrolytic grinding process. A controlled and precise method, the Electrolytic process removes stock electro-chemically. It is *not* to be confused with electro-spark or electro-arc methods. It reduces diamond wheel consumption 80% to 90%.

Combined with electrolytic grinding, these Grinders provide a tremendous advance in grinding ease, speed and cost reduction.

WRITE FOR FREE LITERATURE

Hammond Machinery Builders INC.

1631 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 60

Cuts chipping time 44%

JOB: Chipping flash and parting lines on gray iron castings. Formerly used heavier, slower hammer. Switched to Rotor C-20.

RESULTS: Reduced time from 135 to 75 minutes per casting with the Rotor C-20 hammer. Savings paid for hammer in 5.2 weeks. Short, fast strokes remove more metal and give better finish.

Full details on Rotor Hammers in Bulletin 37A, free on request. For demonstration, call your nearby Rotor Application Engineer or write The ROTOR TOOL Company, Cleveland 32, Ohio.

Here's the RIGHT TOOL for YOUR job!

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS
CLEVELAND, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 61

MOLINE

No. 13CB V-type cylinder boring unit is used either as an individual machine or as one of several automated units in a transfer line for boring automotive engine cylinders.

MR138 four-way, hydraulic feed, drilling, boring and facing machine with hydraulic clamping fixture for tractor main frame housings.

For Greater

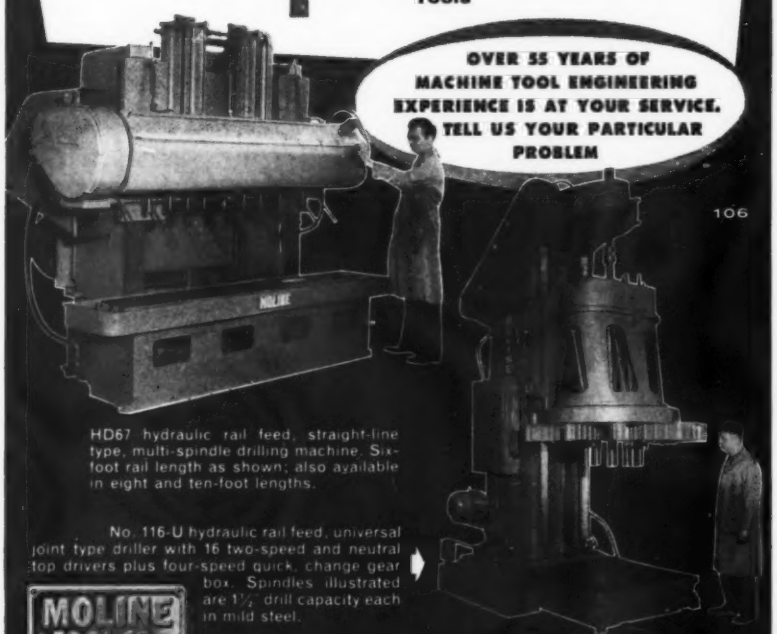
PRODUCTION . . . EFFICIENCY . . . SAVINGS

Use an individually designed "Hole-Hog" Machine Tool for such jobs as...

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

OVER 55 YEARS OF MACHINE TOOL ENGINEERING EXPERIENCE IS AT YOUR SERVICE. TELL US YOUR PARTICULAR PROBLEM

106



HD67 hydraulic rail feed, straight-line type, multi-spindle drilling machine. Six-foot rail length as shown; also available in eight and ten-foot lengths.

No. 116-U hydraulic rail feed, universal joint type driller with 16 two-speed and neutral stop drivers plus four-speed quick change gear box. Spindles illustrated are 1½" drill capacity each in mild steel.

MOLINE TOOL CO. HOLE-HOGS MOLINE, ILLINOIS

MOLINE TOOL COMPANY

REPRESENTATIVES IN PRINCIPAL CITIES

100 20TH STREET • MOLINE, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 62

"Commendable Comments"

"I know that standardization is the old panacea — the cure-all — of all industrial ailments, but if we could standardize such sheet metal parts as small clips and brackets, we could reduce the cost of manufacturing air-frames by $25,000,000 annually."

—John A. Maxwell, Jr., vice president-manufacturing, Temco Aircraft Corp., at the 1956 Industry-Air Force Conservation Conference.

"In industries where automatic dimensional quality control systems have been applied, "actual time savings appear to range up to 70%, scrap loss becomes negligible, and floor space savings have been calculated as high as 75%."

—Louis Polk, president of The Sheffield Corp., at an American Society of Tool Engineers' meeting, Louisville, Ky.

"General-purpose computers are 'lengthening the shadow' of the individual engineer and putting the U. S. in a better competitive position against the mass government training of engineers in Russia . . . Improved designs, simpler operating techniques, and factory training for the users have made general-purpose computers practical for almost any overloaded engineering team.

—Maurice Horrell, general manager of the Computer Division, Bendix Aviation Corp., in Los Angeles.

"Let us not forget in our concentration upon this topic of automation . . . that all progress is of human origin. The driving force of ambition, the unpredictable course of man's inventiveness, and his knack of using his freedom of enterprise to build organizations that produce useful things and create income-producing jobs — these are the indispensable ingredients of progress."

—Malcolm P. Ferguson, president, Bendix Aviation Corp., at the past Third International Conference of Manufacturers.

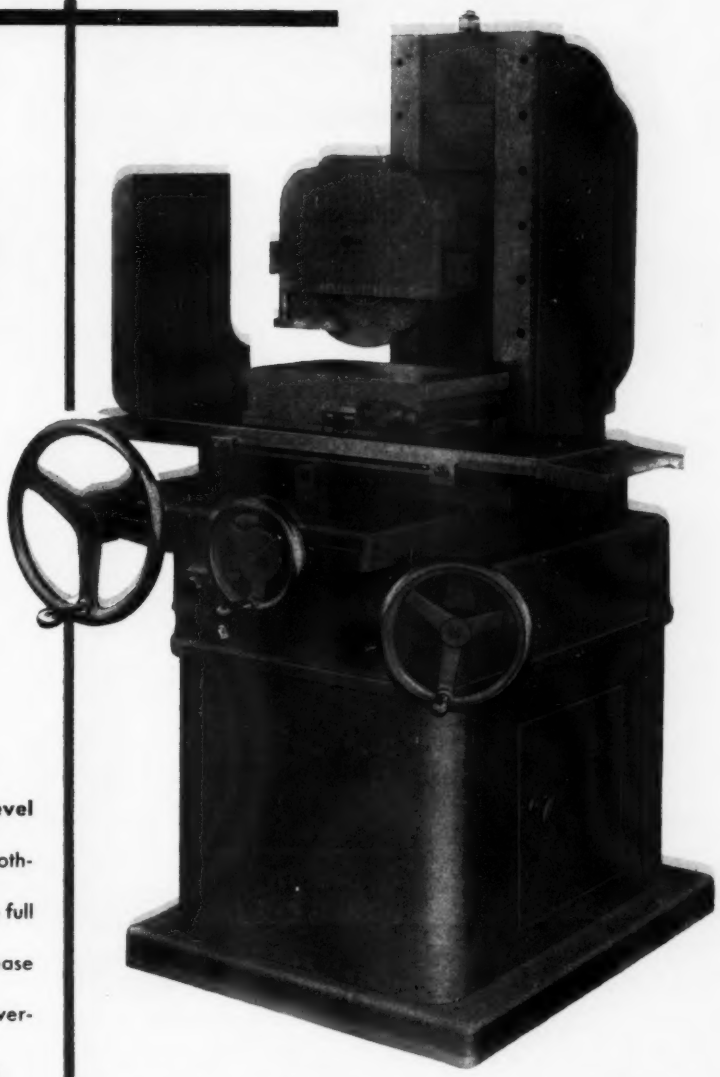
"Someone has said that in some companies any executive who makes a pitch for a higher vacancy and fails to receive the promotion is automatically worthless to the company and usually gets out immediately . . . In practically every instance, however, it occurs because the people who do not get the job don't understand why they were not selected."

—Virgil K. Rowland, assistant to the chief accounting officer, The Detroit Edison Co., at the American Management Association's Midwinter Personnel Conference.

NEW COVEL No. 17

10" x 16" HAND FEED

Surface grinder gives you LARGE CAPACITY at LOW cost...



Set-up time and operator effort are reduced while accuracy is increased by the advanced Covel design features incorporated in this new surface grinder. You can handle die block and general tool room work with remarkable efficiency and speed with the new Covel No. 17 which gives large capacity at low cost.

Note these advanced Covel features:

- **Elevating handwheel** is **below table level** for extra convenience.
- **Timing belt drive** actuates table for smoother grind.
- **Large diameter handwheel** moves table full 16" with only 2¾ turns.
- **Precision ball-bearing spindle** is grease lubricated—sealed for life.
- **Hardened and ground lead screws** on vertical and transverse feeds.

WET ATTACHMENT AVAILABLE

- **Hard chrome table ways** can be furnished to eliminate need for periodic re-scraping.

Work Capacity	Grinding Wheel	Spindle Motor	Spindle Speed
10" x 16" x 14"	12" x ¾" x 3"	2 H. P.	1750 RPM

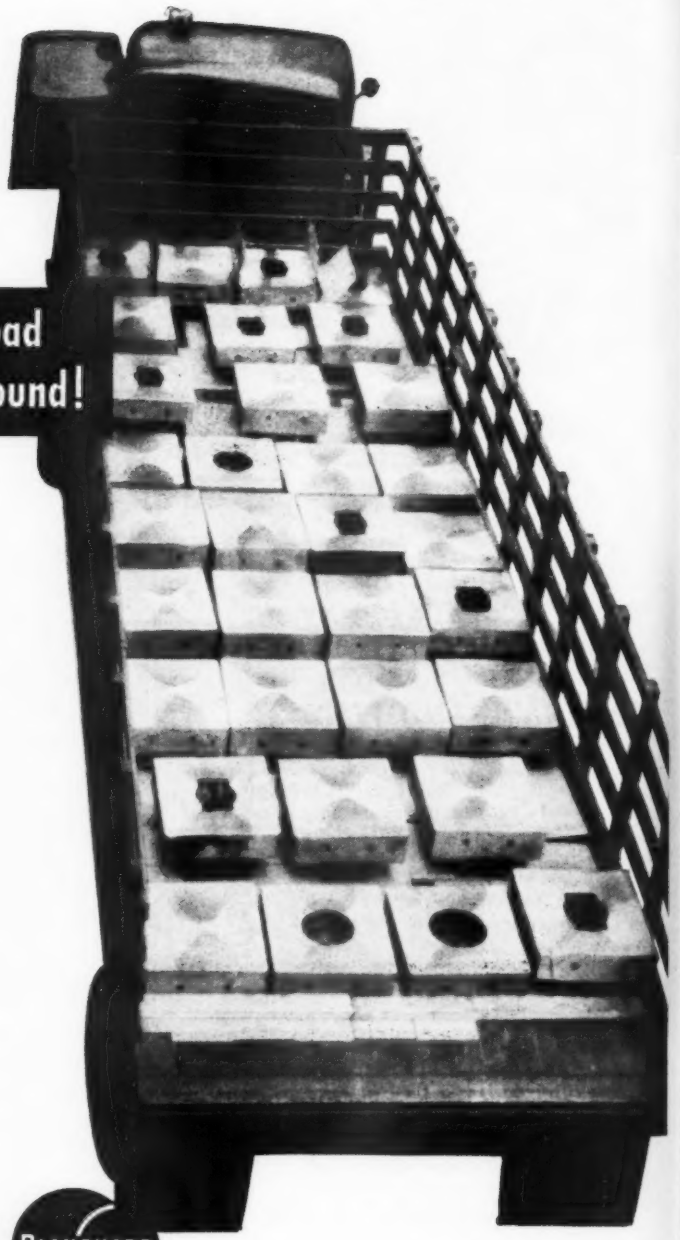
- ***Learn all the facts about the Covel No. 17. Ask for Bulletin 17TP4.***

Covel Offers the Widest Choice in Surface Grinders up to 14" x 24" • Cutter and Tool Grinders & Drill Grinders • Optical Comparators.

COVEL PRECISION GRINDERS

BENTON HARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 63



Precision by the Truckload - - they're Blanchard ground!

This truck is loaded with 14 tons of steel. Its cargo is 33 soft steel plates, each measuring 27½" x 25½" x 11.125", and ground to ± .001" on a Blanchard Surface Grinder.

Dies up to 84" across corners, can be ground on a Blanchard at great savings. Grinding can be controlled without guesswork—leaving a flat, sharp die—as soon as the entire surface is cleaned up. Die resharpening on the Blanchard allows you to get maximum life from your valuable dies and end plates.

Ask for details on the 15 standard Blanchard models.

For best results in surface grinding . . .

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS.

THE BLANCHARD MACHINE CO., 64 State St., Cambridge 39, Mass.

Gentlemen: Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd edition) and "Work Done on the Blanchard" (5th edition)

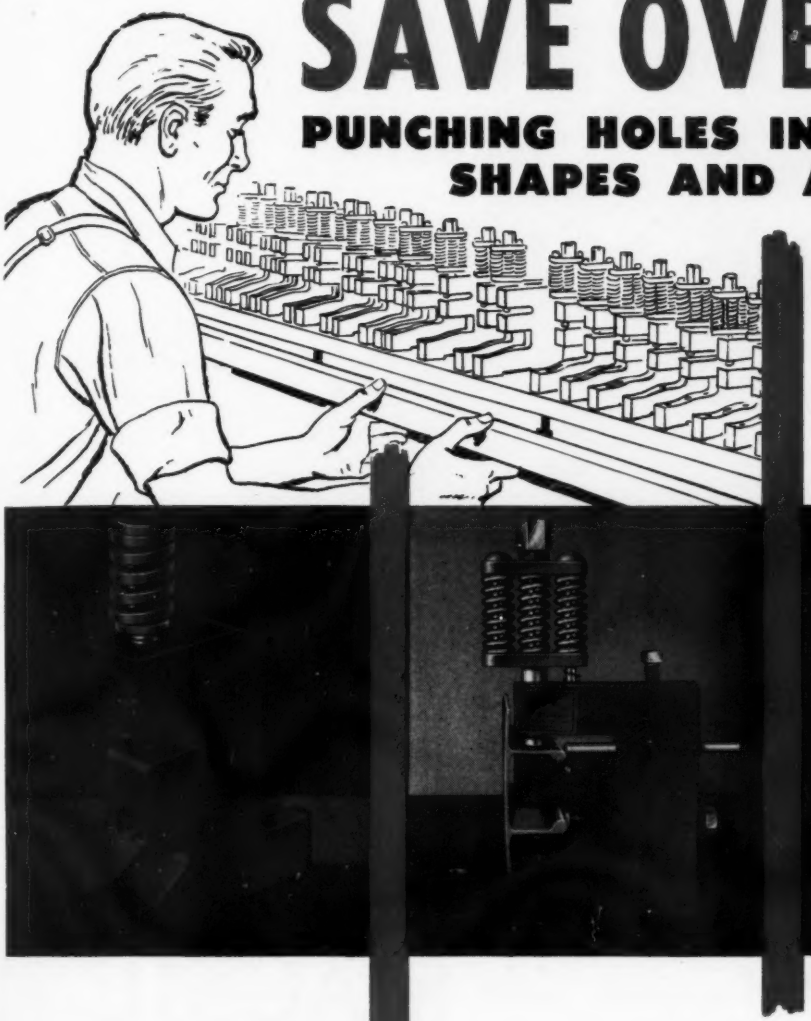
NAME_____ STREET_____

FIRM_____ CITY_____ ZONE____ STATE_____

CIRCLE INFORM-A-GRAM KEY NO. 64

SAVE OVER 50%

PUNCHING HOLES IN EXTRUSIONS SHAPES AND ANGLES!



WALES "C-E" TYPE SELF-CONTAINED TOOLING

A few of the many shapes and extrusions punched with WALES C-E units.

Hole punching of formed and extruded shapes, is a simple operation with WALES self-contained C-E type tooling. Punch, die and stripping mechanism are all integral parts of the unit. Alignment is automatic! The same tooling may be used in any pattern and the set-up is FAST. A wide variety of units is available to fit almost every hole punching need. WALES C-E type tooling is a must for economy minded shops.

SEND FOR BULLETIN No. 27C

Specifications, illustrations and data to help you solve the toughest hole punching problems.

WALES MOBILE FIELD UNITS

See this demonstration shop on wheels. We can arrange to have it show you right at your door. Ask for details.

WALES Strippit COMPANY

"...the Wales-Way is the PLUS-PROFIT way"

AKRON, NEW YORK

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

CIRCLE INFORM-A-GRAM KEY NO. 65

diamond-like quality and hardness!

ACME

DELUXE MODEL SOLID TUNGSTEN CARBIDE DRILL JIG BUSHING

- Wears 50 times longer
- Made to A.S.A. standard tolerances or special requirements
- Made in all types of A.S.A. standards
- Manufactured with full drill bearing surface
- Reduces down time to an absolute minimum
- Non-corrosive and rust-resistant
- Many sizes in stock

Write your distributor or Acme for information and prices on tungsten carbide, micro and standard drill jig bushings.

ACME INDUSTRIAL COMPANY
206 N. Laflin Street • Chicago 7, Illinois • MOnroe 6-4122

CIRCLE INFORM-A-GRAM KEY NO. 66

Photograph courtesy of Western Supply Company, Tulsa, Oklahoma

Read what this man has to say about PORTAGE MILLS!

Mr. D. W. Brady, Plant Manager of Western Supply Company, Tulsa, Oklahoma says,

"Our manufacturing facilities here at Western are devoted almost entirely to heat exchanger production. We have found the versatility of the Portage Mills allows us to do a wide variety of machining operations required in the fabrication of this type of work. We have found the machine to be very reliable and have experienced no lost time for repairs since it was installed."

Mr. Brady's kind remarks are typical of those coming in from across the country ... PORTAGE MILLS are truly the *machine of the year* ... and remember ... Portage costs less to buy. Write for the illustrated catalog ... and ask for a proposal too!

THE Portage MACHINE CO.

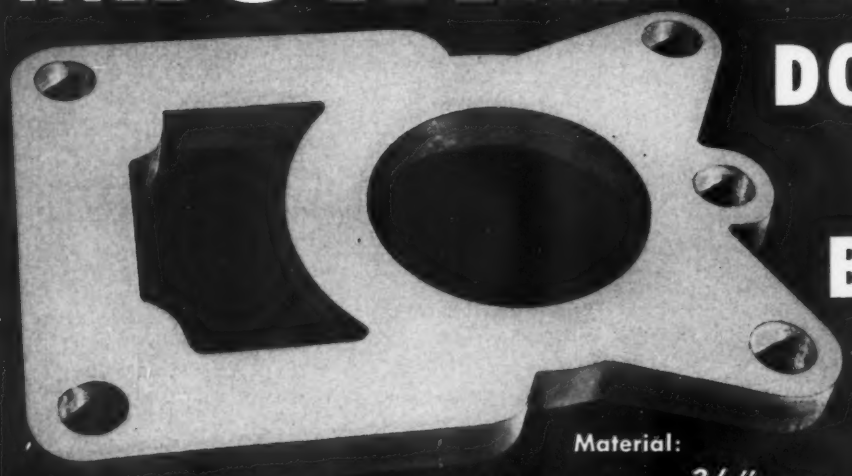
1046 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

CIRCLE INFORM-A-GRAM KEY NO. 67

WILL STAMPINGS DO YOUR JOB BETTER?



Material:
1100 Aluminum—3/8" Thick

CASE HISTORY:

Redesign from casting to stamping cuts piece price 66%... tooling cost 53%

★ **BREAKAGE ELIMINATED**

Wrought aluminum alloy gives greater strength characteristics, eliminating breakage which occurred with the original cast part.

★ **MACHINING ELIMINATED**

Blanked and pierced part is complete as pictured. No additional machining of holes or top and bottom surfaces is required. End result is a better part at lower cost.

★ **COST REDUCED**

Piece price reduced 66%. Original cost of the casting plus necessary machining was $1.45 each in lots of 1000. *Cost of stamping is 50¢ each.*

Tooling cost reduced 53%. Original cost of pattern and drill jig was $301.00. *Tooling for stamping cost $140.00.*

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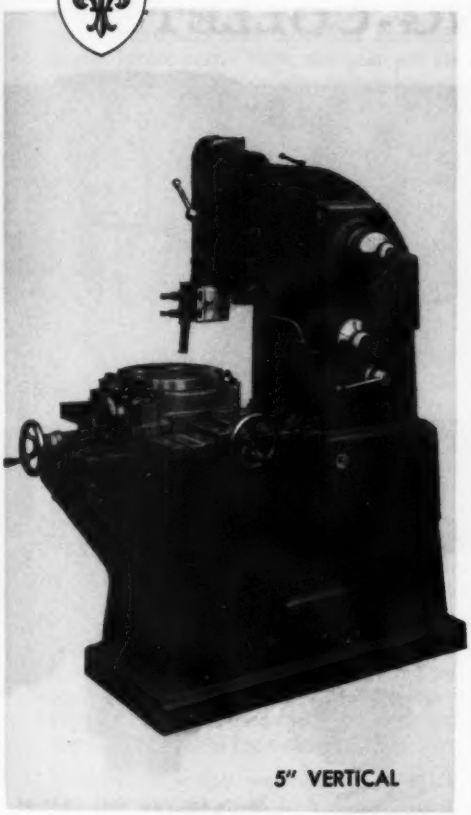

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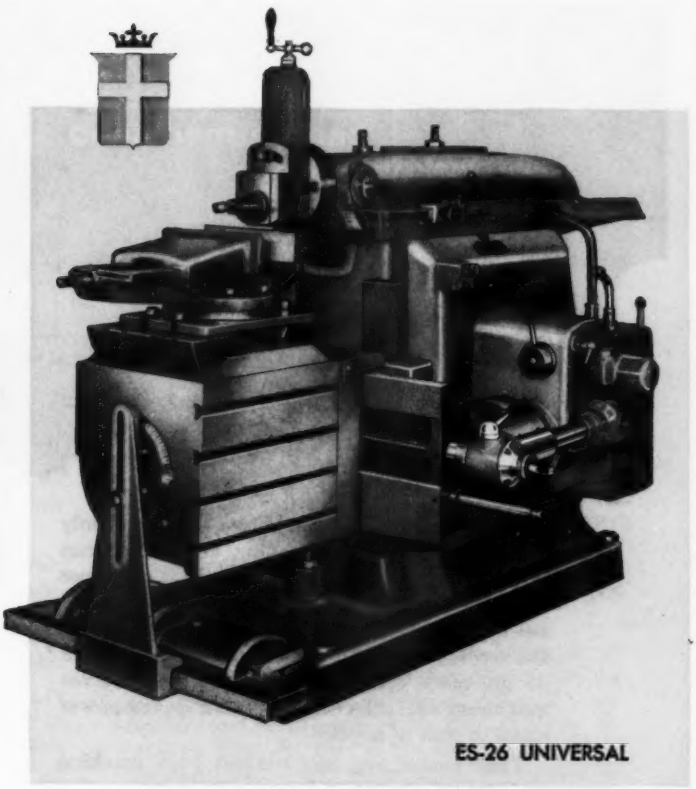

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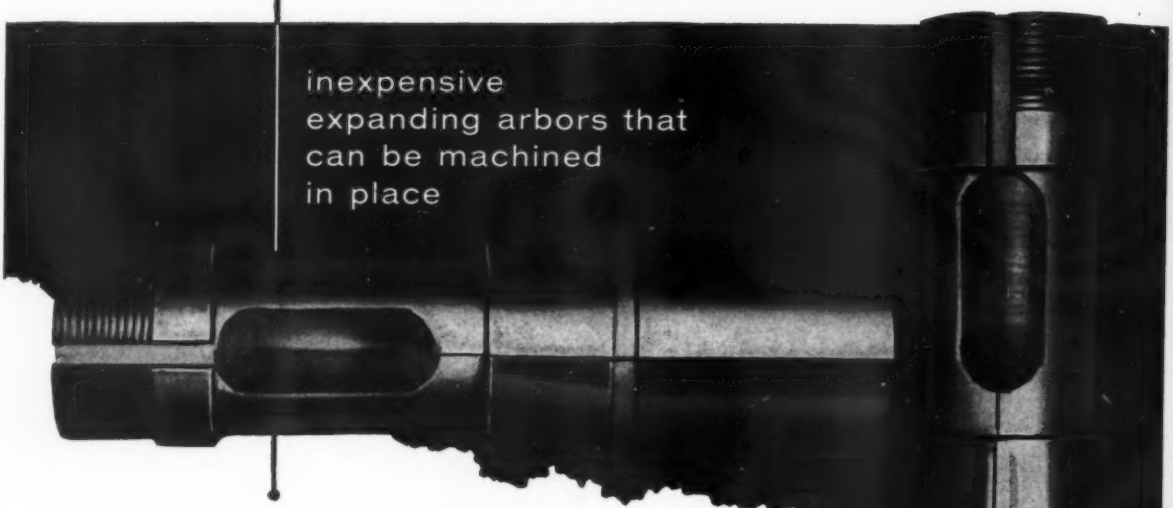

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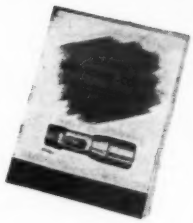

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editorial:

This Editorial Is Not For You . . .

INSTEAD, IT IS for your son, nephew, or neighbor's son, if he is an Engineering College Senior, Class of '57. If you will direct it to his attention he might be very grateful to you.

Dear Senior: Your college career to date has been one of ascending thrills and attainments ever since you hurdled the trials and tribulations of being a Freshman. In your Sophomore year you consolidated your position and got "on target" for elective jobs and campus and team activities that led to a still busier Junior year. Now, this year you are enjoying the honors and prerequisites that belong to a Senior.

But all of this is as nothing compared to the hectic, impressive, and even bewildering succession of job interviews that have been set up for you with representatives of industry who are so avidly seeking your services.

Whatever your major, be it electronics, theoretical physics, mathematics, chemistry, optics, or mechanics, you are being given the full treatment. Contrast this with the days, not so long ago, when an engineering diploma was simply a route sheet for the pavement pounding routine of job hunting.

Now, all the shoes are on other feet. You are being wooed with implications of future success and security that make Horatio Alger Jr.'s heroes seem like skid row bums in comparison.

They are all in the act, aircraft companies, instrument manufacturers, builders of communications and computing equipment, pharmaceutical and chemical firms, ordnance manufacturers and primary metals processors, to name a fair sample.

In fact some recruitment programs are so lavish, particularly where government contracts predominate, that Uncle Sam's Internal Revenue boys are beginning to look with raised eyebrows when such expenditures are pegged as legitimate costs of doing business.

Be that as it may, we freely concede that you can't help but be impressed by the glamour attached to participating in an earth satellite program, a futuristic public power nuclear reactor project, atomic weapons research, radar control of highway traffic, or solid state physics research — a real "ivory tower" refuge.

You must realize, however, that out of every 100 "freshman" scientists and engineers garnered by one of these glamour industries probably 75 of them are on their way out as of their first day of work. That's the way the ball bounces. It isn't a pretty thought, but it is becoming more and more evident that your first year or two is simply what the Navy calls a shake-down cruise, really rough and rugged.

We are not advocating for a minute that you seek a "softer" job, but we do want you to be mindful of an industry that is in equal sore need for your skills, the industry that is so basic to our system of free enterprise that without it free enterprise would be a hollow term indeed, i.e., the machine tool industry.

Admittedly, the machine tool builder, being a rugged individualist and leading exponent of free enterprise, is not offering you ranch-type homes with swimming pools thrown in, nor in most cases (locations) can he offer you 364 days of sunshine per year. But he does offer you a career in an industry that grows, not if our economy grows, but because our economy grows. That makes it a pretty sure thing. And he offers a career that is as challenging to the imaginative engineer and scientist as can be found.

The principal objective of the machine tool builder is to make machine tools easier to operate and, at the same time, capable of more intricate operations, thereby increasing productivity of the machine and operator team.

This means automatic controls, programmed sequences of operation, automatic transfer of workpieces from machine to machine, which when carried to the ultimate means automation. It means computer-like circuitry and memory devices for repetitive production.

This program of progress is dependent upon the skills of the electrical engineer, electronics researcher, metallurgist, physicist and mechanical engineer. All are essential to the designing and creating of tomorrow's machine tools, transfer machines and fully automated lines.

Further, the machine tool industry, although not one of our largest, is extremely competitive and aggressive. And yet, all of our colossal industrial giants depend upon it as much as Charley McCarthy depends on Edgar Bergen. In this industry, every engineering advance creates an impact felt throughout our entire economic structure.

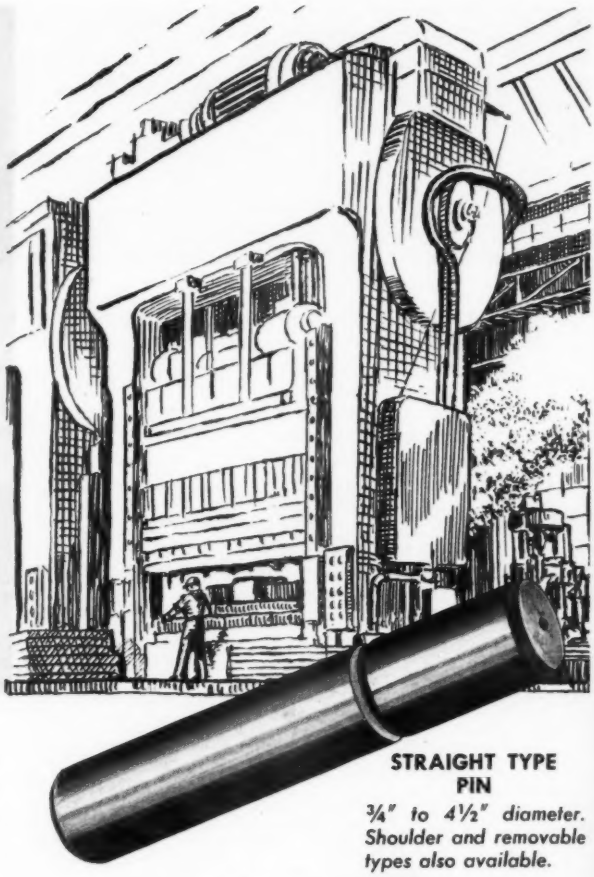
As a member of a machine tool building team you are a bigger frog in the pond than when you are one of 30,000 souls jockeying for parking space within a quarter mile of your desk.

Listen to the machine tool builder's story and you will get an insight into what makes this country tick. You might find a real opportunity to help keep it ticking.

E. Willard Pennington

editor

"We saved $40,000 in 8 months with LAMINA GUIDE PINS and BUSHINGS"



Research and experimentation have proved that guide pins and bushings are almost as important to die performance and upkeep as the design and manufacture of the die itself. Lamina Guide Pins and Bushings, in fact, can effect a substantial savings in production costs as this quotation from an actual user letter attests . . . "On a limited test of Lamina Guide Pins and Bronze-Plated Bushings we have saved approximately $40,000 in die maintenance over a period of eight months."

Precision-produced Lamina Bushings combine hardened steel for strength, bronze plating for free, smooth action to eliminate seizing and scoring. A pre-finished I.D. assures full length roundness and straightness for better fit, finer alignment, longer life. Lamina Guide Pins, made of special, uniformly hardened tool steel, resist wear, bending, "mushrooming". Further, Lamina grinding and burnishing methods insure perfect concentricity and dimensional accuracy. You can be sure, too, whatever your requirements, that Lamina offers a size and type guide pin and bushing for your needs.

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¾" to 4½" diameter. Shoulder and removable types also available.

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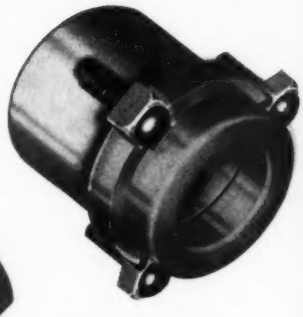

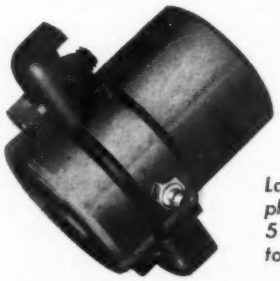

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APRIL 1957

TOOLING & PRODUCTION Magazine

Blanchard Grind at Higher (10:1) Feeds

Fig. 1. MULTIPLE GRINDING of difficult-to-hold jet engine parts is now practical due to the fast loading time, greater holding strength, and higher metal removal rates provided by Ampogrip workholders. Part being ground appears in Figure 3, at left in second row from bottom.

GRINDING TIME SLASHED BY NEW FIXTURING

by Almon E. Fuller
Group Leader, Process Planning

PRATT & WHITNEY AIRCRAFT DIVISION
United Aircraft Corporation
East Hartford, Connecticut

SAFE, ACCURATE HOLDING of irregular-shaped workpieces has long been a problem for production engineers. This problem reaches considerable magnitude in the holding of non-symmetrical forgings and castings on a Blanchard vertical-spindle surface grinder while grinding a reference plane. But, now, engineers at Pratt & Whitney Aircraft have come up with a practical solution — one with a myriad of associated benefits that are ringing up some very substantial savings.

The solution is built around a standard work-holding vise, the Ampogrip, both jaws of which are made up of numerous fingers that mold around the workpiece and set to whatever the contour may be. The gripping end of each

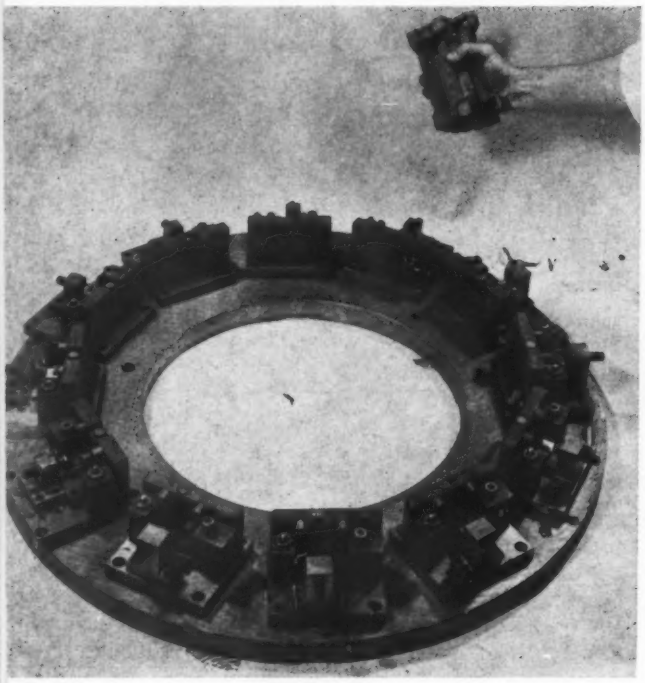


Fig. 2. SLASHED TOOLING COSTS and set-up time are evidenced by this comparison of a conventional 12-station special fixture and the special locators now required for similar work on an Ampo 10-station fixture. The handful of locators is all that must be changed from job to job, the basic Ampo fixture never being removed from the machine. In contrast, it was formerly necessary to move heavy fixtures, such as that shown, on and off the machine each time a new job was run.

rectangular finger is radiused, and carries a carefully controlled fine serration. The rear ends of these fingers project into a "liquid" mass of tiny bearing balls that completely fill a closed chamber, the volume of which remains constant.

As the vise jaws are closed on the workpiece, pressure on the first fingers to make contact causes the fingers to push back and displace balls in the reservoir. This continues until each finger has made contact and can move no farther. In repetitive production, this mass is relatively inert and fingers remain in the form of a work nest with finger movement confined to that necessary to compensate for dimensional variations of the workpiece.

Whereas each different engine part formerly required a costly special fixture, the Ampogrip concept now permits a basic fixture to remain permanently on the grinder, with only special locator pins or parallels needed to provide a nest on which to set the piece between jaws of the vise.

Briefly, here are the major directions in which our benefits (and savings) accrue:

- A 10 times greater downfeed of the grinding wheel and a corresponding increase in the rate of metal removal, because of the greater gripping power of the Ampogrip work holders.
- Faster loading of workpieces, because of automatic compensation (by holding fingers) for minute dimensional and surface variations from piece to piece.
- More work stations per machine, as a result of combined fast loading time and safe, higher wheel feeds.
- Elimination of special fixtures, fixture storage, and fixture transport.
- Reduced machine downtime for setup and repairs. The operator — man or woman —

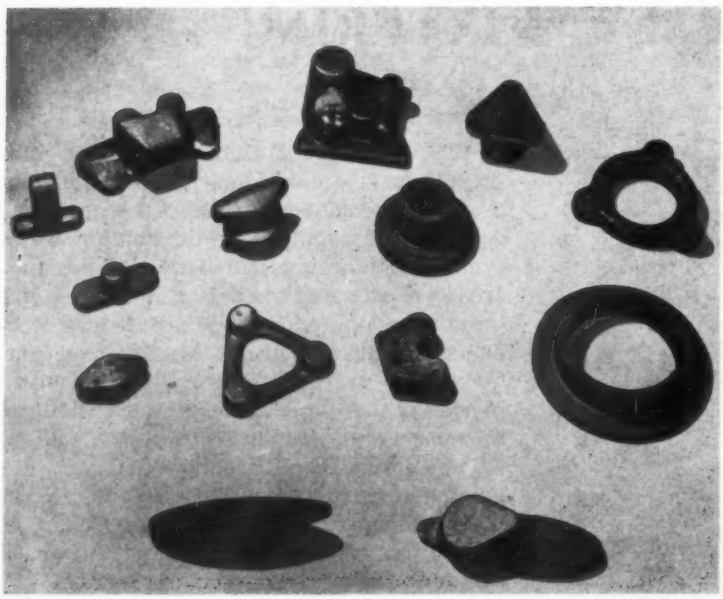


Fig. 3. DIFFICULT-TO-HOLD in conventional fixtures, these typical jet engine parts now being successfully held in multiple-finger vises bor Blanchard grinding. Materials are heat-resistant, stainless steel alloys. The part shown at the bottom appears alone in Figure 4. All other parts are shown with the surface ground, or to be ground, face down.

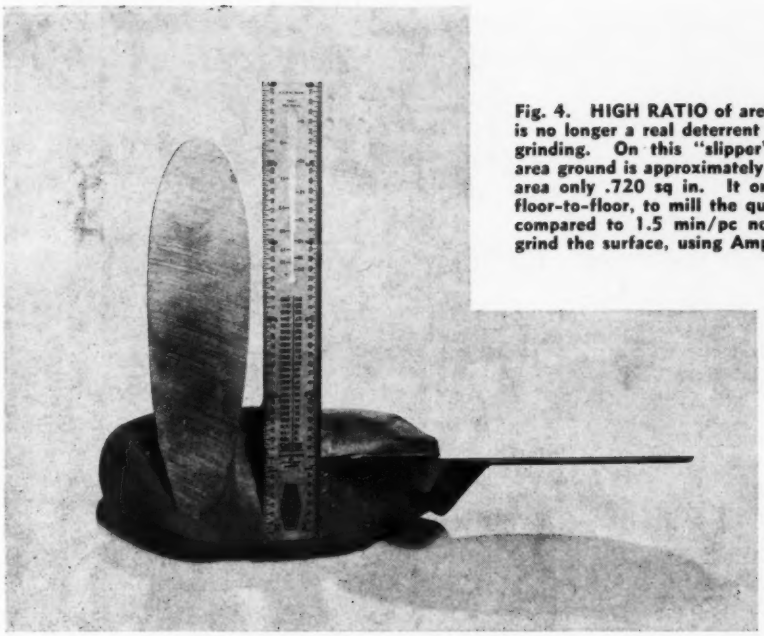


Fig. 4. HIGH RATIO of area ground to gripping area is no longer a real deterrent to efficient fixturing and grinding. On this "slipper" part held in clay, the area ground is approximately 5 sq in, and the gripping area only .720 sq in. It originally took 10 min/pc, floor-to-floor, to mill the qualifying surface (left) as compared to 1.5 min/pc now required to Blanchard grind the surface, using Ampo fixturing.

can now quickly change locators or vises.

- Overall much greater productivity per machine and a corresponding saving in floor space.
- Substantial savings in wheel costs, due to more rigid work holding and resultant improvement in wheel life.

Establishing Reference Surface

In processing a part, the first objective is to establish a machining datum — a reference plane from which the part is dimensioned, a locating surface. This surface can be milled, but many of the high-temperature alloys in current use for jet engines are highly subject to work hardening and more than one operation is often required to achieve the necessary degree of flatness. Moreover, surface compression strains are set up that adversely affect the quality of any necessary subsequent welding operation.

Another disadvantage of milling, in respect to critical defense production, is the dependence built up on such strategic materials as tungsten, cobalt and molybdenum used in the cemented carbides and super-alloy tool steels. In the event of war, such materials could well be in short supply. The less dependent we are on such materials, the better off we are.

We like to grind where possible — for speed, to avoid severe work hardening and surface compression strains, and to avoid strategic tool materials. Our problem is to hold the work securely, and at a reasonable cost. In the past, we often employed grinding even though the immediate tooling and production costs were excessive.

If the part can be held magnetically, tooling costs are held to a minimum. However, the holding of an odd-shaped rough casting or forging — subject to dimensional and surface variations — for the first cut very often is extremely difficult and must be done with special fixturing. Or, this **was** the case.

Pratt & Whitney engineers gained their first experiences with the new type fixturing by running just one piece at a time. The first engine part tackled was taking 16 min/pc to mill reference surfaces and 2 min for a subsequent clean-up grind. Using an Ampogrip vise and the 10 times greater downfeed it permitted, we eliminated the milling operation and ground the reference surface to the necessary dimensions in just three operations . . . for a total of 3 min/pc.

Eliminating Special Fixtures

Entering into a new jet engine program, we found that we had 82 engine parts to be Blanchard ground; each requiring a special fixture if conventional tooling were to be used. With these fixtures costing as much as $1,500 each and delivery time of 16 to 20 weeks, we decided to give the Ampo fixturing a real test.

Two of the new fixtures, with special locator parallels or pins for adapting them to specific engine parts, are sufficing where 50 to 100 conventional fixtures would have been required.

Fig. 5. CONTOUR-FOLLOWING action of Ampo multiple-finger jaws can be seen in this setup for grinding the "slipper" part shown in Figure 5. Station at left shows the simplicity of locator arrangement for establishing height. This consists of simple plate with set screws locked by check nuts and ground in place. Photo also illustrates simplicity of gaging equipment required.

We expect that, eventually, many of our Blanchards will be equipped with the new type fixturing. Whereas conventional fixturing has always required a substantial expenditure for the Blanchard work on each engine model tooled up, the new fixturing will be just as permanent as magnetic chucks, for example, and will require only that locators be provided in each tooling program. The saving, therefore, will be repeated each time a new engine enters production.

The Ampo fixtures were originally mounted on the magnetic tables which have been standard equipment on these grinders. However, the magnetic feature is no longer necessary and actually has become a liability on the class of work we have been discussing here.

With a magnetic table, there is always the danger of power failure or of an operator forgetting to turn on the power. Results can be disastrous. Magnetic materials become polarized and cling to the vises; you can't wash them off. Wipers have been installed on the original Ampo tooling in use, to keep vise rails clean of abrasive and chips. Bearing surfaces are hardened to about 55 Rockwell C and chrome plated, which resists the tendency for abrasive to cling enough for wear to set in.

Ampo fixtures are now permanently secured to a non-magnetic table. Coolant is piped so that by coolant pressure and centrifugal force every bit of abrasive will be washed out.

The locators can be permanently assembled to a base plate fully interchangeable in the fixture. This nesting then can be stored in the tool crib between runs and, at any time, be pulled from storage and quickly installed. Eventually, such base plates will be standardized with a pattern of tapped holes on 1" centers. Carbide-tipped pins of varying heights can be properly spaced for 3-pin support of the workpiece. When a part becomes obsolete, the nest can be broken up and pins and plate returned to stock ready to be made up quickly for some new job. It will be necessary to seal unused pin holes against the entrance of abrasive. The vise itself could be installed in about 3 min.

The Ampo fixtures are expected to virtually eliminate the large storage area presently required for the heavy, bulky special fixtures not in immediate use. Many of these conventional fixtures weigh 600 to 800 lbs and require an overhead crane to load and store them.

Assuring Operator Safety

There is also a safety hazard associated with the frequent transport of such large, heavy fixturing and there is a danger of damage to the fixture itself.

Women can now be employed safely as Blanchard operators on part production requiring fixturing; with the Ampo tooling, a woman can easily handle locators and even set up a job. Also, they can lock up the piece in a vise because it doesn't require a great deal of pressure.

Even though a conventional fixture was built to the specifications for one engine part, there were variations from one workpiece to another. As a result, the work holder would not properly hold each and every piece and occasionally, when the wheel was brought down, the piece would be torn from its holder and fly from the machine.

With the old fixturing, there also was a tendency for the operator to really sock up the locking device in an effort to hold the piece securely. With the Ampogrip, simple hand tightening is sufficient to hold the piece securely against the greater cutting forces associated with a higher (10 to 1) downfeed of the wheel.

It actually takes relatively light pressure to hold the workpiece securely, enabling thin-walled shells to be held without distortion. Also, it is possible to hold securely parts having only a .060″ to .070″ edge on which to grip.

Decreasing Set-Up Time

Casting and forging variations formerly caused considerable time to be expended in loading a workpiece in the holder. Shimming was not uncommon and several gagings were frequently required while loading a piece into position.

Average time to set a piece in a conventional work holder was 15 to 20 min, whereas only 2 to 3 min are required to set a piece in the Ampogrip vise.

The decrease in setting time is permitting the use of fixtures with a greater number of stations. On one job, a 20-position Ampo fixture will be substituted for a 6-station conventional fixture, with expected production of 20 pcs in half the time formerly required to grind the 6 pcs.

The more rigid setups result in substantial grinding wheel savings. On most of this Blanchard work employing conventional fixturing (not magnetic holding force), we experience a loss in wheel wear equivalent to the amount of stock removed. This is due to slight wobble of the workpiece. Now, instead of this 100% wheel wear factor, we are enjoying only a 10% wear because of the greater holding strength of the Ampogrip.

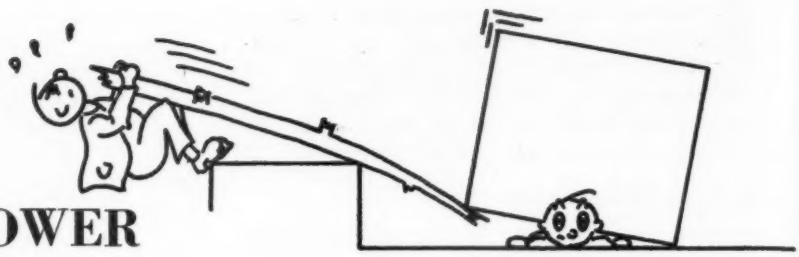
Savings Compounded

As an example of the tremendous savings being attained at Pratt & Whitney Aircraft through the engineered application of the Ampogrip principle, let's return to the present engine program where we substituted 2 Ampo fixtures and the necesary locators for 50 to 100 special fixtures of conventional design.

Because of reduced loading time and 10 times greater wheel feed, the parts produced in the quantities required for just one engine model will eventually realize an estimated savings of hundreds of hours in direct labor alone. Add to this the savings from eliminated special tooling, eliminated operations, less spoilage, less tool handling costs, and other factors and the potential savings in terms of the present dollar become almost astronomical . . . on just a small part of our total Blanchard activity. end

Fig. 6. HIGHER FEED RATE is possible with the 4-station Ampo fixture (also Fig. 5) shown here ready for grinding the "slippers" part. Grinding the parts with conventional fixturing permitted a wheel feed of only .004″/min, due to insecure holding. The new fixturing's greater holding strength permitted the downfeed to be increased to .040″/min.

20 Ways to Ease the Manpower Squeeze



by Carol E. Reuss
Associate Editor

IT'S A SELLER'S MARKET, say the personnel experts, and the problem of staffing skilled workers isn't becoming any easier. Trained help is scarce, and no real relief is in sight until the mid-1960s. Companies, as a result, are trying out every even remotely feasible method of gaining more engineering talent and manhours within the next 10 years. The most promising of both proven and possible methods of alleviating the shortage of engineering personnel are summed up in these 20 ways.

1. Utilize everyone in the organization at his highest skill. In other words, don't waste the "gray matter." Assign non-technical jobs to engineering assistants, is the recommendation of some of Ohio's top personnel executives. Provide more labor-saving tools such as computers, they add, and cut paper work to the bone so the engineer or other highly skilled employee is available for bigger, more complicated assignments.

2. Hire new people according to actual needs, not according to what the department heads think they need. As a job opening occurs, analyze the job's talent requirements to make certain which level of training and skill is necessary. Then, fill the opening accordingly. A pet peeve of personnel directors is to receive a requisition for a graduate engineer, when the position could be filled adequately by a junior engineer, engineering assistant, or draftsman.

3. Give present employees an educational boost — upgrade them. Lectures and workshops, during the work-week or after-hours, are effective. Pratt & Whitney Company sponsors 40-week courses for employees in basic engineering and advanced electrical engineering. Cross Company has set up a school to train machine designers. Emerson Electrical Manufacturing Company has helped pay for telecasting a college mathematics course over a St. Louis educational TV station. A number of firms in Cincinnati have pooled their resources to offer a 15-week TV series aimed at upgrading supervisory personnel.

4. Offer financial assistance to employees taking college and university courses. Norton Company, Raytheon Manufacturing Company, and Timken Roller Bearing Company are but three of the many firms offering part- or full-tuition payment to full-time employees enrolled in accredited institutions. Timken, in addition, has inaugurated a cooperative program with Tri-State College in Angola, Ind., in which qualified Timken personnel study to be engineering technicians. The student-employee spends one quarter at the college, the next at Timken. The company pays full salary, under a special arrangement, while the employee is enrolled in the program. As the employee finishes one year of service at Timken, the bank note signed for the salary while at school is cancelled.

5. Hire qualified non-technical graduates for technical positions. With the addition of on-the-job or specialized training, many non-technical college grads with an aptitude for technical work adequately fulfill many engineering and sales assignments.

6. Hire women and older workers whenever possible. A recent Labor Department study of manpower needs indicates that industry will have to revise personnel policies and drop prejudices to make way for using more women and more older persons. Mandatory retirement programs, in some cases, will need re-evaluation.

7. Sponsor and support industry-education days and educational institutes that bring high school teachers into plants to see what industry does and what it needs. They'll return to the classroom with an understanding of industry's problems and an enthusiasm for preparing their students for positions in industry.

8. Encourage the study of mathematics and science within the high schools and instill in the students the urge to continue their studies either in colleges or in apprentice programs. Volunteer to serve on guidance committees, invite the students to visit the plant, sponsor

youth groups and Junior Achievement companies.

9. Offer scholarships to deserving students who otherwise would not be able to continue their education. Arrange to pool economic resources with other plants if such a program is too large an undertaking for one company.

10. Hire science and mathematics teachers during the summer months and/or on a part-time basis. The results can be two-fold: The company can use the teacher in his job capacity, and it can reap indirect benefits when the teacher's newly-acquired practical knowledge of industrial processes and problems is carried into the classroom. The teachers will welcome both the experience and the addition to their yearly salary.

11. Hold seminars for college professors and teachers, to let them know about the advancements being made in industry. Here too, the results will be realized when the prof returns to the classroom and relays the information to his students. Large companies, like General Motors and General Electric take this idea one step further by sponsoring summer educational programs — brush-up sessions — for teachers, in an effort to help them gain a more intimate knowledge of their subjects.

12. Give financial aid to colleges and universities. The amount of money paid in tuition seldom covers more than half of the college's expenses. Scholarship aid accompanied by a stipend to the college equal to the tuition is increasing, reports Dr. John R. Dunning, Dean of the Engineering School at Columbia University, but not fast enough. Such contributions are vital if the colleges are to modernize and expand, and if they are to be able to afford the best possible staffs.

13. Take part in cooperative education programs (see T & P — June '56, p 66). These, in effect, offer on-the-job training and experience for the college student while he is in college, and eliminate a major portion of the in-plant training usually necessary when new graduates are hired.

14. Hire engineering students for summer jobs — and use them at their highest skill, not as yard-men. Give the student an opportunity to apply the technical information and scientific concepts he has learned in the classroom. And, perhaps, entice him to apply for a permanent job after graduation.

15. Lend engineers to schools and colleges to lecture and teach. Ralph G. Smith of Dow Chemical Company reported, at the recent Plant Maintenance & Engineering Conference, on a plan advanced by David Sarnoff. It would establish a National Education Reserve of teachers in math, sciences, and related subjects, to be drawn from industry. Industry would release with full pay for one year qualified people who have reached the retirement age, and would also encourage qualified employees to teach night school without giving up jobs in industry. Many firms are offering engineers to schools. A plan at Arthur D. Little Company is unusual, but meritorious: The company hires college grads in pairs, sends them to summer school to obtain credits, if needed, and assigns them to a combination teaching-engineering routine. One teaches in local schools while the other works at Little's, changing each semester. After three years they make their choice — teaching or industry.

16. Promote the idea of attending technical institutes or junior colleges to students who don't wish to or can't complete the usual four-year stint. These graduates often make excellent engineering assistants, and with additional in-plant training, sometimes move along much farther in industry.

17. Look to the small colleges as well as the giant universities for top-grade engineering graduates: "Podunk can produce good engineers," comments a seasoned personnel recruiter, "just as M.I.T., for example, can produce a poor one." Medium and small-size firms may not be able to afford the expense involved in college recruiting — which runs upwards of $2,600 per grad hired for many firms — but they can at least contact the smaller colleges in their areas for opportunities to interview graduating engineers.

18. Use part-time help, and use it most effectively by maintaining definite work schedules for such employees. More and more, retirees are taking part-time jobs in industry — working for nominal wages and aiding industry and themselves.

19. Promote rigid standards within the schools. Be vocal in urging that college work remain on the advanced level, so graduates will be more fully equipped to take on the increasingly more complex jobs in industry.

20. Try sub-contracting some of the work which requires highly skilled manpower. Although not a solution to the skilled manpower shortage, it can be a relief for firms faced with an acute skilled talent void. It merely shifts some of the pinch to another company which is willing and able to take it. This is an "emergency measure," cautions the personnel director of a large manufacturing firm, "and it should not be misconstrued to indicate that the shortage of skilled manpower is universally eliminated by sub-contracting work to another company."

end

NUMERICAL CONTROL SYSTEM PERFECTED

Digital information punched into tape automatically controls the Pratt & Whitney vertical precision hole grinder built for Ford Motor Company's Aircraft Engine Division. Air, forced through holes in the tape, operates the machine's controls.

DELIVERY OF THE FIRST of Pratt & Whitney's numerically controlled hole grinders to Ford's Aircraft Engine Division brought with it the announcement that Pratt & Whitney has perfected a system for application on its line of jig borers, vertical hole grinders, and rotary tables.

A giant step forward toward complete automation of this type machine tools, the P & W tape control system makes possible automatic accurate positioning within 0.0001" or 5 sec of arc. Because of this, vital machine tools which formerly could be used only as toolroom equipment can now be made available for efficient volume production purposes.

The punched tapes used in the Pratt & Whitney system are easily and economically prepared, and take the place of costly fixturing. Thus, automatic programming and operation become practical for short production runs and for machining one or two pieces with multiple holes, at a minimum of operator fatigue.

The numerical control used is based on the common decimal system and the dimensions shown on a blueprint are punched on tape as easily as numbers are tabulated on an adding machine. This system eliminates the necessity of making complex mathematical "translations" which are required by automatic control systems based on binary numbers.

The tape reader uses a pneumatic sensing system: Air is forced through holes in the tape to an enlarged chamber with a neoprene diaphragm which provides enough force to operate a reliable industrial control limit switch. The whole system is rugged and reliable under shop conditions. end

Aircraft jet engine production will be implemented by Pratt & Whitney's numerically controlled vertical precision hole grinder. Units are: Control Cabinet (left); Hole Grinder (center); Control Panel; Cabinet (right) containing tape into which digital information has been punched to automatically and accurately position the workpiece.

Modern Air Gages

HOLD THE LINE ON GAGING COSTS

by E. M. Procopio
Plant Superintendent
ACCURATE BUSHING CO.
Garwood, New Jersey

DRILL-JIG BUSHINGS are highly competitive and expendable items requiring close tolerances. These close tolerances require production facilities which will permit sale of the bushings at a reasonable profit.

At Accurate Bushing Co., we knew that up-to-date high-speed automatics, grinders, honing and lapping machines were necessary for a long-range solution to the production problem. Our gaging had to be up-dated too, for inadequate gaging methods could delay production enough to obviate the benefits of our plan to modernize our production facilities.

OD tolerances range from .0002″ to .0004″ and ID tolerances from .0003″ to .0004″ depending on bushing size. We formerly checked all ID's by plug gages to determine whether the bushings had reached the required dimensional quality level. But the GO — NO GO gages had certain features that limited their usefulness.

First, of course, is the lack of indication of actual part size. A fixed-limit gage shows just one condition — whether the part is or is not within tolerance limits. To keep scrap loss low, the machine operator must know more than that. He must know whether the part size is trending toward either of the limits and whether the machine needs readjustment. A fixed-limit gage cannot give him this information.

Gaging by GO — NO GO gages is also relatively slow and, simple though it may look, requires a certain degree of skill. Even skilled men can disagree on measurement when using plugs, because the sense of touch varies from one individual to the next. In fact, gaging decisions may vary with the individual as he gets

Bushing ID is gaged with workpiece in the grinder. It is then removed, rotated on the air plug to check out-of-roundness, and slid endwise on the plug to check taper and bellmouth.

Closeup of gaging operation shows slotted air plug entering the bushing. The gage is set to zero by the knurled master on top the grinder.

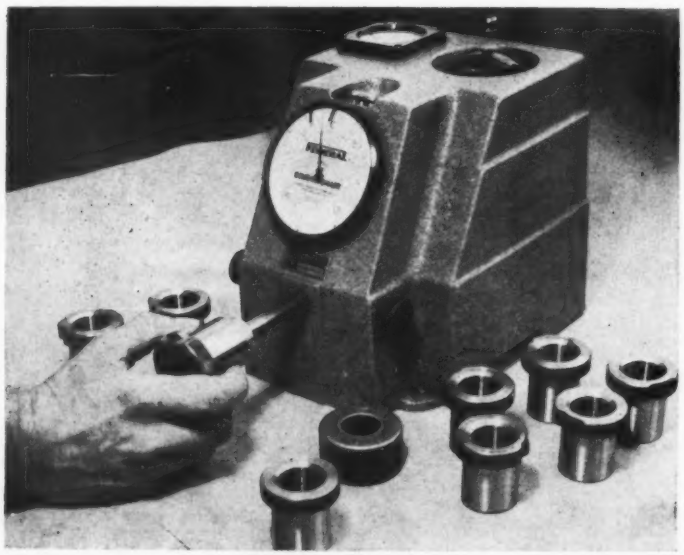
tired or tries to gage too rapidly. We found that considerable training was necessary to get fairly accurate measurements from machine operators.

Another feature of plug gages that concerned us was their relatively high over-all cost, because of their short life. Regular tool-steel plugs were ready for scrap or salvage after several thousand bushings had been gaged. While chromium-plated gages would give us double the wear, the cost of gage salvage or replacement was still an appreciable item.

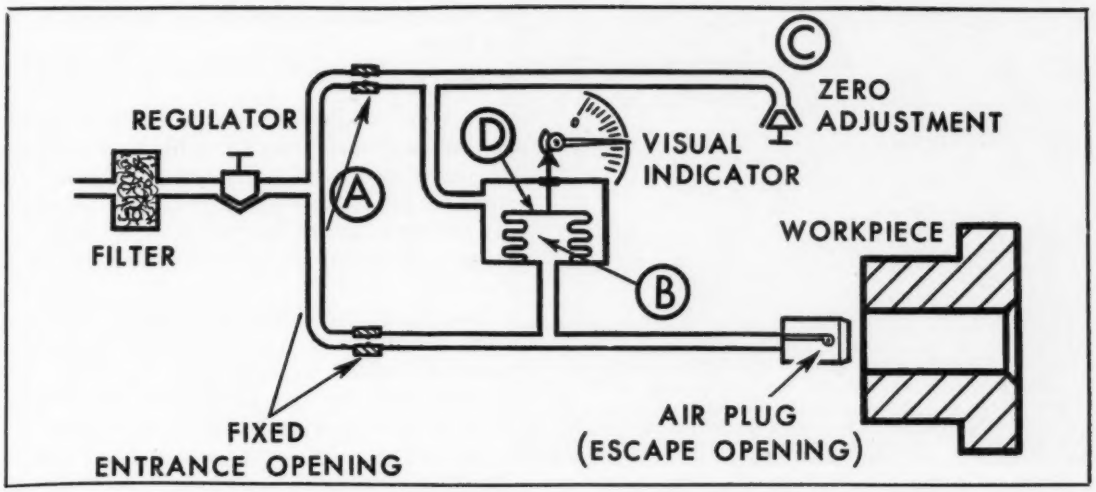
Gaging System Selection

In selecting the new gaging system to match the high production equipment in speed and capability, it was decided that indicating type gages were essential to supply an operator with the information needed to keep his machine within control limits and to keep his scrap loss low. With such gages, the operator can read part size quickly and accurately. And he can also recognize whether the machine is drifting toward undersize or oversize holes, and then can make the exact adjustments necessary to keep the work within specified dimensions.

The visual and precise indication of erratic machine performance or too-frequent machine drift can act as a warning to the maintenance crew (through the operator and his supervisor) of any trouble within the machine tool, such as wear of machine elements. A failing spindle bearing, for example, may not be apparent with fixed-limit gages. But an indicating gage would permit the operator to spot quickly the inability of the machine to reproduce piece



For inspection of bushing ID, the air plug can be mounted directly on the gage instead of using an air hose. The gage is set to zero by the one master shown in front of the gage. Only one master is needed because of the high stability of the differential-fixed type of gaging system.



Dimensionair gaging system schematic. Air from line divides into two channels at A. Portion passing through openings in gaging plug is limited in its escape by inner wall of the bushing, once plug has been inserted. Resulting pressure which varies as bore size varies, is exerted on inside of air meter bellows (B). Escape of air flowing through other channel is limited by zero adjustment (C) and exerted on opposite side of bellows. Amount of differential between these two pressures determines position of bellows platform (D) which, in turn, controls position of indicating hand. Since dial graduations each represent .000050" (50 millionths), position of hand shows actual amount that bore of bushing varies from the nominal which is represented by zero on the dial.

after piece within required limits.

Various types of indicating gage equipment were studied and tested before standardizing on air gages. They were selected because they are fast and accurate. In addition, their ability to hold a reading as long as desired by the operator eliminates eye fatigue from wide and rapid indicator fluctuations. The resulting confidence and trust in his gage equipment permit the operator to realize increased production with little or no effort on his part.

Although first cost of both air gage and master was high, the life of an air plug as compared with that of our previous gages actually resulted in a lower gaging cost per piece. Any air plug can be used constantly for 2 to 3 years before salvage or replacement becomes necessary. In this time, it should gage up to 150,000 parts.

Its life, of course, just as the life of any other gage, depends on the care taken in its application and, to some extent, on the machining method with which it is used. When any type of gage is used in the presence of abrasive particles or lapping compound, the rate of wear accelerates. This is particularly so with plug gages, which come into intimate contact with the surfaces carrying the abrasive material. Since air plugs are smaller than the bushing holes being measured, and there is no metal-to-metal "wringing" contact, wear is correspondingly less.

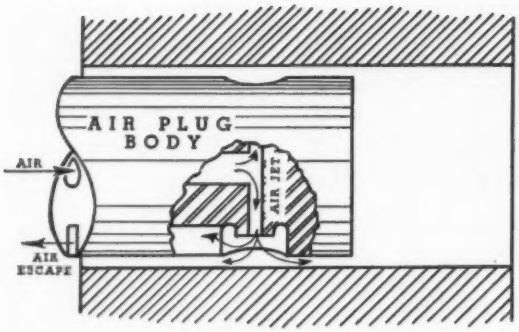
Furthermore, a conventional plug gage begins to change in size—and therefore becomes less accurate—as soon as it is put into use. An air plug, however, does not depend directly on its size to gage a hole accurately.

An additional advantage of gaging without close contact between gage and work is the elimination of possible damage to the ID surface finish of the bushing. As the surface finish of the holes may be as fine as 4 micro-inches (on customer-specified parts that we also manufacture), wringing or forcing could easily damage the finish.

Air-Gage Requirements

Once the decision to go into air gaging was made, we faced another selection of the type of air gage that would best fit our needs. As we manufacture nearly 10,000 different combinations of bushing styles, types and sizes, plus special and modified standard bushings, the cost of masters became of major importance. We selected the differential-fixed gages which require only one master in each ID size, in preference to the variable-type gages which require two masters per size.

The differential-fixed system, as used in the Dimensionair (made by Federal Products Corp.), operates on a balanced-circuit principle, similar to that of the Wheatstone bridge. Compressed air from the plant line is filtered, pressure-regulated, and fed into two opposing channels within the gage. The pressure is equalized in the two channels by nonadjustable jets. In one channel, air escapes through the gaging plug. In the other, it escapes through a zero-setting valve.



Cut-away of gaging plug in bushing. Air, passing through jets at top and bottom of plug, hits wall of bushing bore. Most of the air takes escape path provided in plug body. Some of the air escapes between bore and plug, according to the dimensional variation of the bore.

With a master over the air plug, the air escaping through the zero-setting valve is balanced with the air escaping from the plug. When the master is replaced by a workpiece, any change in air pressure resulting from a difference in size between work and master is translated into a precise direct measurement of the difference on the dial.

The system is stable enough that the gage scale can be accurately calibrated with one master. This stability is due to taking the zero adjustment out of the gaging leg and putting it into the balanced leg. Because this system is balanced, any drift in air regulator pressure is distributed equally to both sides of the differential meter and has no effect on the accuracy of the gage.

Gaging Time Cut

Once the air gages went into use there was a marked decrease in gaging time—especially important in our 100% inspection program. It was found that the machine operators could apply the air plugs rapidly with little chance of misgaging, as the plugs locate themselves in the hole.

The ID of each bushing is gaged with the work still in the grinder. The bushing is then removed, rotated on the plug to check for out-of-roundness, and then slid endwise on the plug to check for taper and bellmouth. These dimensional characteristics, which are particularly troublesome in machining long bushings with small bores, could not readily be detected with fixed-limit gages. An air gage spots any inaccuracies in these characteristics almost immediately.

One of the less obvious, but most important, phases of this procedure switch was the development of a keener sense of responsibility for producing accurate work among the operators. They found they could work to closer tolerances than they had believed possible. The operator's increased appreciation of precision standards and ability to maintain them has helped us live up to our name—Accurate Bushing Co.

end

ROTARY STORAGE UNIT OFFERS TRUE FEEDING FOR PROCESSING LINES

A radically new high-capacity storage unit, designed for parts or blanks that can roll, has been developed for use in automated processing lines. The rotary unit offers a true demand-feeding system from a controlled mobile storage medium. As shown here, the unit is used to store and feed ring-gear blanks for a broaching operation. Capacity with this part is over 300 units.

Each unit is custom-tailored to a specific job and assembled from standard components, by Gear-O-Mation Division, Michigan Tool Company. The rotary form is provided in either circular or oval shape to suit particular floor space requirements. Adaptability to any rolling part operation is therefore virtually unlimited. Handling, even at high speed, is gentle enough to assure delivery of unmarred parts.

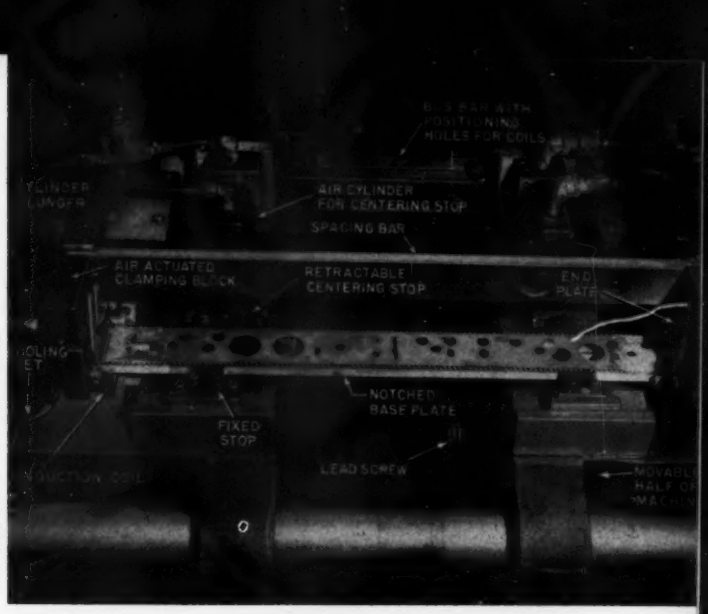
In operation, the parts are guided through a silhouette "accept-reject" device to fully caged double tracks and gravity fed to the elevator. The elevator is of the push type working off a stroke-lift pneumatic piston. Lifting speed of the elevator is variable through a closed-circuit hydraulic cylinder coupled to the air cylinder. The double-shaft elevator and the double-track storage unit not only increases capacity but also facilitates double entry and double exit from or to separated points. Either elevator shaft can be operated fully independent of the other.

As the parts leave the elevator at the top of the equipment they are gravity rolled through the circular tracks to the exit chute take-off. The parts can be positioned vertically or horizontally for the following machine operation. Air cylinder-operated gates in the tracks control movement of the parts on demand.

When used for stockpiling of parts, the equipment automatically stops when full capacity has been reached. This is accomplished by using the static weight of parts to mechanically move air valves which cause the gates to open or close.

The rotary storage unit is ruggedly built for long full-time use. Absence of complex controls reduces service requirements to a bare minimum.

Air Clamping Typewriter Frames for Brazing



Adjustable air fixtures and heating coil setup for silver brazing IBM typewriter carriage frames at the Kingston, N. Y., plant.

THE CARRIAGE FRAME in IBM typewriters is a long, notched base plate with a pair of stamped, irregularly-shaped end pieces silver brazed to the ends. Since the end pieces support the platen and a variety of mechanical linkages on the assembled machine, they must be precisely parallel and at right angles to the base plate. To achieve correct alignment and prevent wobbling during the brazing cycle, International Business Machines Corporation devised a clamping arrangement operated by two pair of synchronized air cylinders.

The endwise holding action is produced by a pair of opposed air-actuated clamping blocks which press the end pieces firmly against the base (see illust.). The transverse holding action, necessary to keep the base at right angles to the end pieces, is produced by a second set of air cylinders which press the base plate against a pair of fixed stops. To prevent the two end pieces from tipping inward when the clamping pressure is applied, a spacing bar is laid between them. The two joints are brazed by induction coils positioned beneath the assembly — near the ends of the base plate and along the sides of the end pieces.

Before the three parts are assembled in the fixture, the surfaces around the joint area are coated with Handy-Flux, which is allowed to dry before the parts are installed in the fixture to eliminate dripping. While the flux is still semi-fluid, a preformed shim of 0.005″ thick Handy & Harmon Easy-Flo 45, a low-temperature silver brazing alloy (flow point 1145° F), is pressed against each end of the base plate. As the flux dries, it cements the shim in place and thus simplifies assembly when the parts are placed in the fixture.

During assembly, the notched base plate is laid against the centering stops and the end pieces are then placed in position. A pair of pins on the end pieces which fit into holes in the base plate help the operator position them accurately. As a final step, the operator places a ⅜″ slug of 1/16″ Easy-Flo 45 wire above the joint to provide the proper volume of brazing alloy. When the assembly is completed the operator places the spacing bar in position between the end pieces, trips the air valve which actuates simultaneous clamping action by the end blocks and centering stops, and starts the brazing cycle.

After the 36-sec brazing cycle, a timer turns off the current and actuates air jets to cool the joints and solidify the brazing alloy before the assembly is removed from the fixture.

As the alloy melts, the follow-up pressure from the end clamping blocks moves the end pieces slightly inwards to take up the space left by the melted shim. This also squeezes out the molten flux and minimizes flux inclusions, to produce a stronger joint. Since the base plate is heated locally, it undergoes little expansion during the brazing cycle. Whatever expansion does occur is absorbed by the slight compressibility inherent in air fixtures, so there is no problem of warpage from clamping both ends of the base. Production rate for the carriage frame is slightly more than 2 min/frame or about 225/8-hr shift.

The brazing rig is constructed in two independent halves which can be set any distance apart to accommodate carriage frames from 12″ to 30″ long. The working distance is adjusted by a lead screw which moves the right-hand side of the fixture along the guide rails. The induction coils, manufactured by Induction Heating Corporation, also can be shifted along the bus bar to accommodate various size jobs.

end

SHOP SHOTS: Versatile Lathe Tooling for Five Sizes of Valve Parts

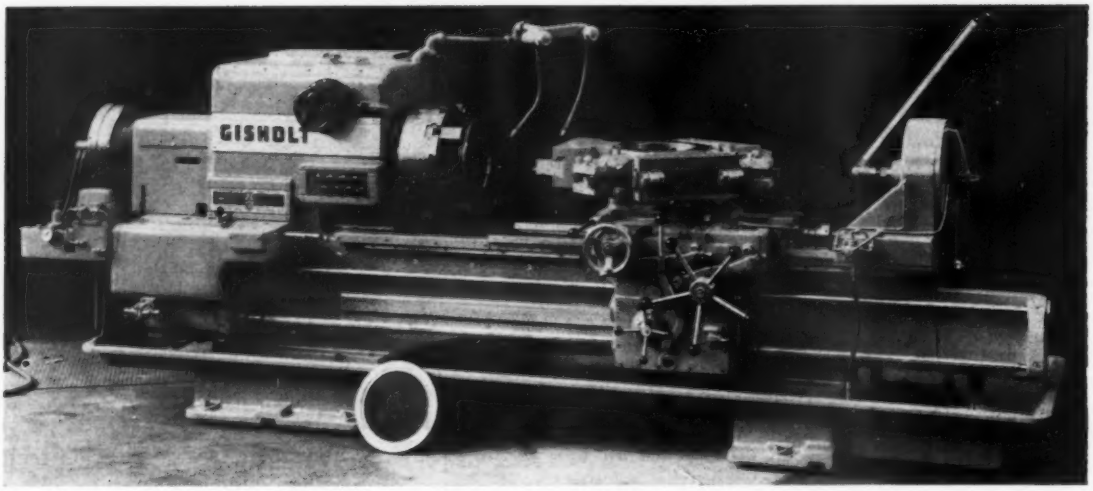


Fig. 1. With the bed ways gapped, this Gisholt 2L saddle type turret lathe will, upon demand, swing work of 26½" diameter for a distance of 12½" from the spindle flange. On the right hand end of the bed is the pneumatic thrust bar which is fed through the turret for the operation shown in Figure 5.

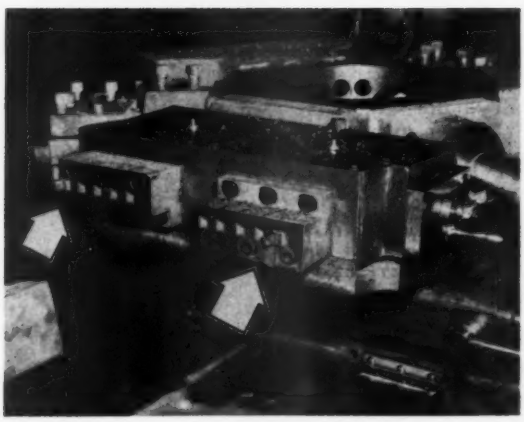
BUYERS OF MACHINE TOOLS are expressing an increasing need for standard equipment which, with some special tooling, can handle a variety of fussy workpieces while remaining able to perform standard duties should the production load fluctuate.

Exactly this versatility is provided in the Iowa Valve Company's plant in Oskaloosa, Iowa, by a standard Gisholt 2L saddle type turret lathe which has replaced three other machines. This lathe is equipped to machine low-pressure valve gate seats of 4", 6", 8", 10", and 12" diameters with a minimum of changeover time from one size to another due to careful tool planning. In spite of a goodly number of operations, floor-to-floor time ranges from 3.7 minutes for the smallest seat to 8 minutes for the largest.

The accompanying shop shots show some neat tooling innovations. However, the basic features of the lathe remain available for standard chucking work.

Fig. 2. A single tool in the first turret station rough faces the valve seat. In station No. 2 this circular dovetail is machined in the faced surface by the tooling of Figure 3.

Fig. 3. These two tools (the rear one upside down) are hand-fed in at the dovetail angle. Hence the rear tool cuts the OD of the dovetail while the front tool cuts the dovetail ID. The additional tool slots are to accommodate the tools for cutting dovetails in workpieces of smaller diameters.



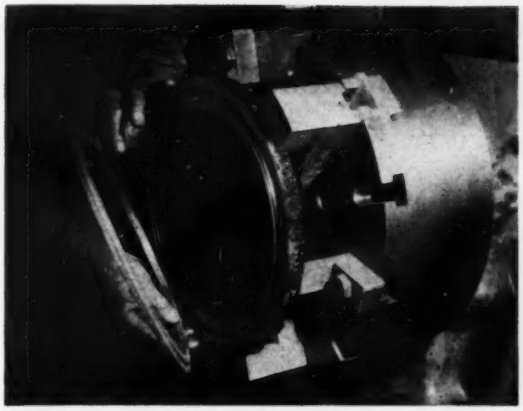


Fig. 4. After machining the dovetail, the operator sets a brass ring in place manually preparatory to rolling it into the dovetail as shown in Figure 5.

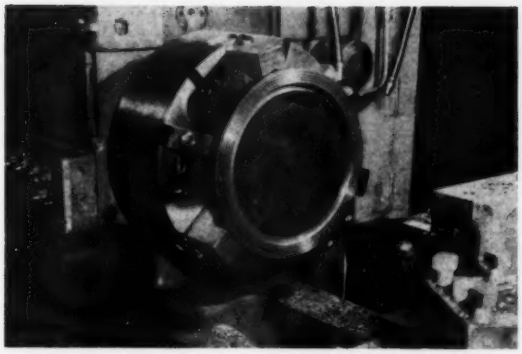


Fig. 5. Here the brass ring has been rolled into the circular dovetailed groove. This is done in turret station No. 6. For this operation, space requirements require indexing past stations No. 3, No. 4, and No. 5.

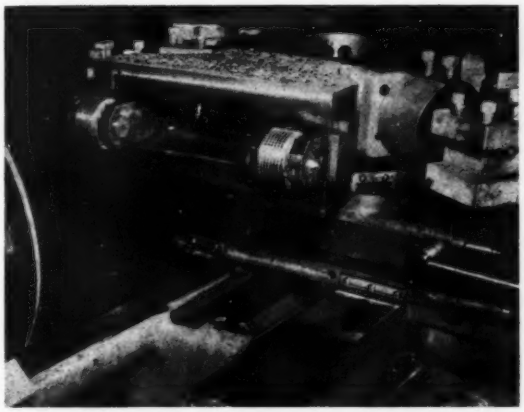


Fig. 6. Here are the rolling-in tools. The tool-holding block is T-slotted to permit quick adjustment of the rollers to smaller sizes. The serrated faces of the rollers tend to dig into the brass, thus preventing slippage or burnishing.

Fig. 7. The rolling-in tools of Figure 6 are forced against the revolving brass ring by this pneumatically actuated thrust bar (see Figure 1) which "reaches" through station No. 3 to push against the roller tool block of station No. 6.

Fig. 8. At turret station No. 5 the impressed serrations in the brass ring are faced off, and this view shows the brass ring chamfered on its OD and ID by the tooling of station No. 4; the final operation.

Fig. 9. The ID and OD chamfering tools of station No. 4. Both chamfers are cut at the same time. From the apparent angles of the tools it will be noted that the ID chamfer is cut by the front tool and the OD chamfer is cut by the rear (upside down) tool.

end

New Precision Process Grinds Aircraft Servo Valve Components to 0.00010" Accuracy

NEW PRECISION GRINDING TECHNIQUES now make it possible to match vital aircraft servo valve pistons and cylinders within 0.00010" accuracy to assure instantaneous valve response in the operation of aircraft control surfaces. Use of the new method has stepped up production rates as much as double on servo valves for Chance Vought jet aircraft. Overall costs have also been cut in the manufacture of these high pressure hydraulic system assemblies.

The servo valve is the key to the operation of the vital airfoil surface actuating system which controls the direction of high speed aircraft in flight. It is made up of two basic parts — the cylinder or sleeve and the piston or slider.

Precision machined ports in the sleeve and "lands" on the surface of the slider must be perfectly matched to specifications (Fig. 1). Past experience on similar jobs indicated that the precision forming and matching of these two parts was the most critical factor in their production.

Previous attempts to produce interchangeable parts were not fully successful. Rejects were high and the amount of regrinding required on both parts proved prohibitively high in cost.

Working closely with Chance Vought process technicians, metrology engineers of the Sheffield Corporation developed a unique production method using precision grinding equipment designed and developed by Sheffield to solve the problem.

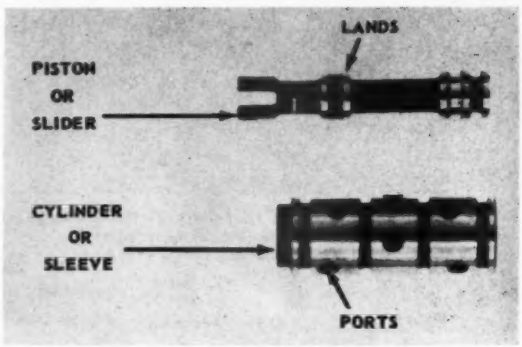


Fig. 1. A matched servo-valve cylinder and piston are shown here. The piston lands are ground to match the cylinder ports. Final grind often required accuracy within 0.00010".

This procedure utilizes Multiform grinders that shape the circumferential contours from alloy bar stock with Crushtrue abrasive wheels and Cavitron equipment that machines the ports by the ultrasonic method. The critical final grind-to-match utilizes a Model 121-C Micro-Form grinder with an extended work table and tandem optical system (Fig. 2).

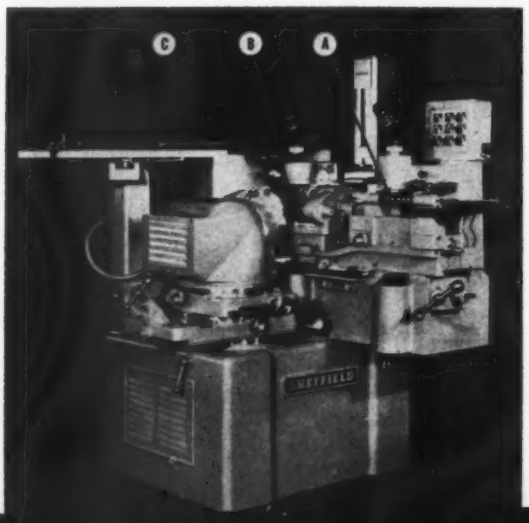
The finish grind is accomplished through simultaneous optical comparison of each cylinder port and its corresponding piston land. The slider or piston is ground at position B in Figure 2. The ports of the matching cylinder are simultaneously viewed through the other scope at position A to determine the depth of grind required by the operator at B. This final grinding operation actually matches the lands on the slider to the ports of the sleeve.

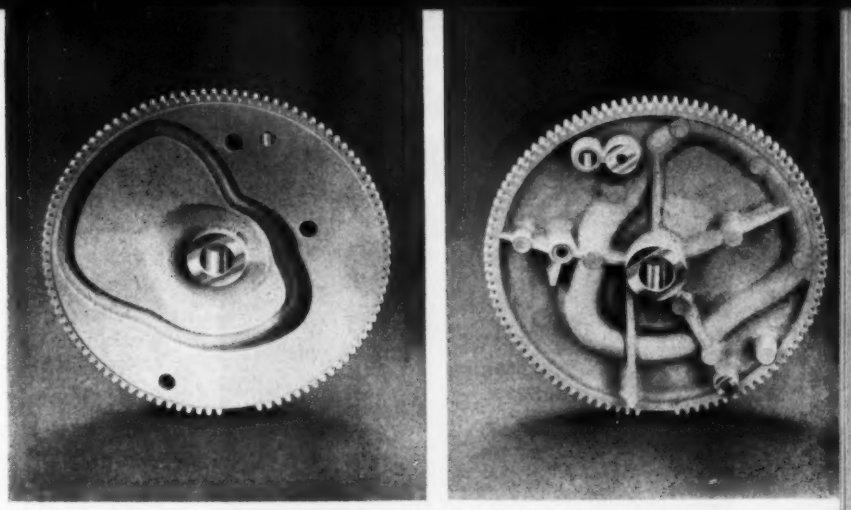
Before utilization of this high precision grinding technique, both parts had to be ground, imposing a double production load. Under the new setup, only the slider or piston is ground and the first matching grind is usually sufficient to pass the assembled flow test. Any that do not pass are reground in the same machine, using in-process air gage control, permitting 0.00010" accuracy. Usually only one regrind is required to pass inspection.

Under the old method, a dozen regrinds were often required, with many parts ending up as scrap due to lack of close control.

end

Fig. 2. Overall view of the Sheffield Model 121-C Micro-Form grinder used for the final grind. Note position of the cylinder reference piece at (A) and the piston being match ground at (B). A handy 50-to-1 pantograph with vernier adjustment is included at (C).





The workpiece — a Webcor record changer cam gear. A standard Swanson-Erie chassis is tooled with special units to perform the operations of reaming the center hole, facing the center hub, facing the outer edge (all from above and shown at the left) and reaming a 0.156" hole and spot-facing three bosses from underneath, as shown at the right.

SPECIAL AUTOMATIC MACHINES FROM STANDARD UNITS

by Frederick P. Netznik
Consulting Engineer
Skokie, Illinois

IN SMALL AND MEDIUM sized manufacturing plants the need for low cost automatic and semi-automatic machines increases steadily.

Great strides in automation have been taken by the larger companies to meet the growing demands of production costs and competition. The scope of the advances and the savings realized by the giants in industry serve only to point up the importance of well designed special purpose machines to the smaller firms — without offering any direct application information, or suggesting a solution to the problem of the capital investments that are involved.

Too often, with the restrictions of a low budget and short lead time, attempts are made to solve production problems with a minimum of direct application experience. This frequently results in a machine which is not adequate for the production requirements.

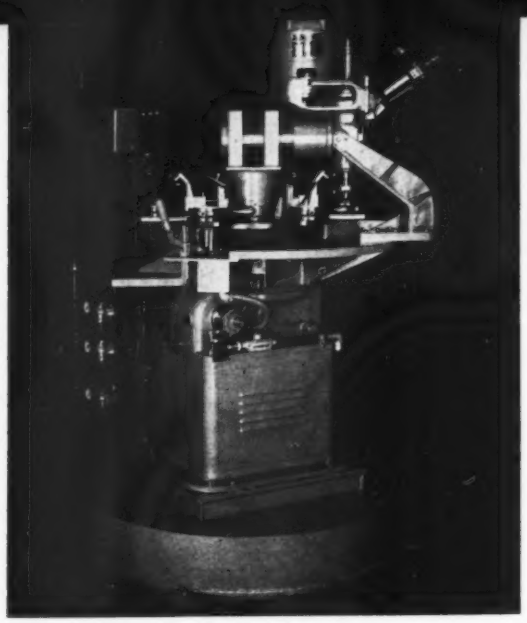
Standard units, however, if used wisely, can eliminate the risk in building special purpose machinery that has a predictable cost, build time, and performance rate.

Standard devices are available for various metalworking operations, for workpiece feeding, and for indexing and positioning. They provide an excellent basis for a realistic approach to a well designed special purpose machine. The selection of proven components, used "as is" or altered from standard to suit a particular requirement, reduces the cost and the risk that is inherent in wholly special components.

The wide variety of standard drilling heads, tapping heads, boring heads, work feeders, workpiece positioning and feeding devices, quills, mounting brackets, indexing machine chassis and various other units available from stock make the acquisition of automatic machines by medium sized and small companies economically feasible — with a minimum of lead time and engineering skill.

A machine conceived along these lines was built for Webcor, Inc., Chicago, Ill., leading producer of phonograph record changers and tape recorders. It performs operations on a record changer cam gear which formerly required five machines. The previous production schedule was eighteen hours per 1,000 parts, involving five operators. The new machine, manned by one operator, produces 1,000 parts in only five hours. Quality and accuracy are consistently maintained.

The reaming of the center bearing hole had to be done without guiding the reamer to permit total access to the upper face of the workpiece to accomplish a facing operation. Therefore, the fixtures must be rotated on an index table which would position them accurately



The center column of the Swanson-Erie chassis terminates in an over-arm which supports the Bridgeport milling head for the operations performed from above. The special reaming and facing tool chucked in the Bridgeport spindle is fed by a solenoid-operated Bellows air feed unit.

under the center of the reaming head with consistent accuracy. It was also desirable that the basic chassis should lend itself readily to the convenient mounting of the various standard heads selected for the machining operations.

Considering these requirements, a Swanson standard indexing chassis was selected. The work table of the chassis is indexed by a cross-over cam system and positioned by a highly accurate wedge device which satisfies the demand for accuracy. This index system has been in use for many years on high speed index equipment with very satisfactory results.

The Swanson chassis further provides a circular key slot around the central bearing housing. In this slot are located various standard brackets which serve as convenient and accurate mounting surfaces for either top or bottom mounting of the machining components.

A particularly important feature of the chassis is a stationary center plate mounted inside the actual indexing table of the turret. The center plate provides a mounting surface for the boring head support bracket and for a workpiece clamp actuating cam.

Six manually operated, collet type, holding fixtures are so mounted that they extend beyond the perimeter of the revolving index table to provide necessary machining access from top and bottom. The workpiece is loaded manually at station No. 1 and locked by rotating the locking handle of the holding fixture. At this position the workpiece clamp is in the retract position to permit loading and unloading of the workpiece.

Stations No. 2 and No. 6 are idle. This provides additional operator safety and added protection from coolant splash.

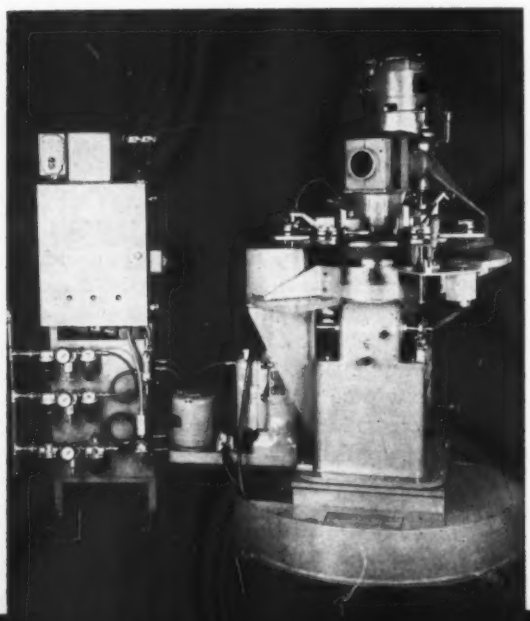
Station No. 3 reams the center hole, faces the center hub and faces the outer edge of the workpiece. At this station, of course, the workpiece holding clamp remains in the retract position to provide machining access to the entire face of the workpiece.

These operations are accomplished by a special reaming and facing tool mounted in a standard Bridgeport milling head. Feed cycle of this head is performed by a solenoid operated Bellows air feed unit. This provides simple and positive interlock of the feed and retract cycle at this station. The Bridgeport head is attached to a special mounting bracket which in turn is mounted to the stationary center section of the index table.

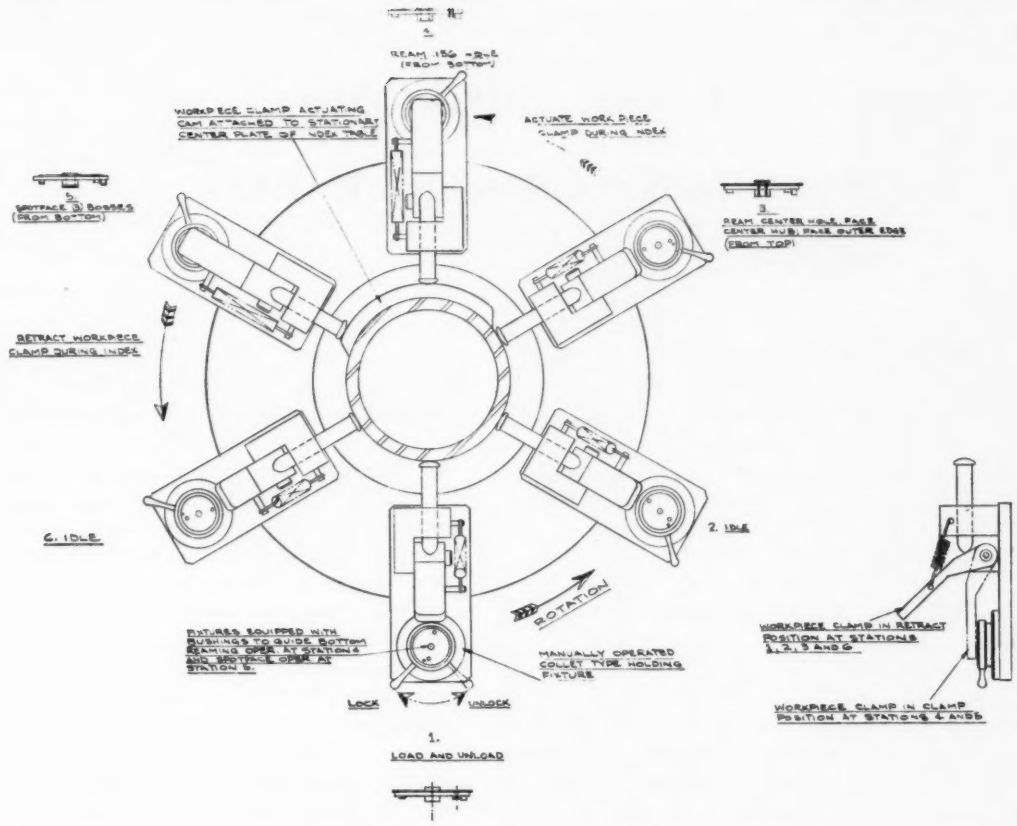
As soon as the holding fixture is indexed clear of station No. 3, the workpiece clamp which is attached to each fixture is cammed down to maintain workpiece position against the locating face of the holding fixture. Thus positioned, work can be accomplished from the bottom side of the fixture.

At station No. 4 a 0.156" diameter hole is reamed from the bottom. Since this hole must be reamed to a decimal center as well as a decimal diameter, a hardened bushing is provided in the holding fixture body at the proper location to pilot the reamer.

A Keller Airfeed drill was chosen for this operation. This unit was a logical choice since its unique and compact nose mounting feature permitted convenient installation to the in-



At stations No. 4 and No. 5 the operations are performed by power units mounted below the index table. The "upside down" units include a Keller Airfeed drill, a Hartford drill unit and a three-spindle Ettco drill head.


4.
REAM 1.56 +.00 -.02 (FROM BOTTOM)
WORKPIECE CLAMP ACTUATING CAM ATTACHED TO STATIONARY CENTER PLATE OF INDEX TABLE
ACTUATE WORK PIECE CLAMP DURING INDEX
5.
SPOTFACE 3 BOSSES (FROM BOTTOM)
3.
REAM CENTER HOLE, FACE CENTER HUB, FACE OUTER EDGE (FROM TOP)
RETRACT WORKPIECE CLAMP DURING INDEX
6. IDLE
2. IDLE
ROTATION
FIXTURES EQUIPPED WITH BUSHINGS TO GUIDE BOTTOM REAMING OPER. AT STATION 4 AND SPOTFACE OPER. AT STATION 5.
MANUALLY OPERATED COLLET TYPE HOLDING FIXTURE
LOCK
UNLOCK
1.
LOAD AND UNLOAD
WORKPIECE CLAMP IN RETRACT POSITION AT STATIONS 1, 2, 3 AND 6
WORKPIECE CLAMP IN CLAMP POSITION AT STATIONS 4 AND 5

verted mounting bracket provided by the Swanson index chassis.

The workpiece clamp remains cammed in support of the workpiece during index travel from station No. 4 to station No. 5.

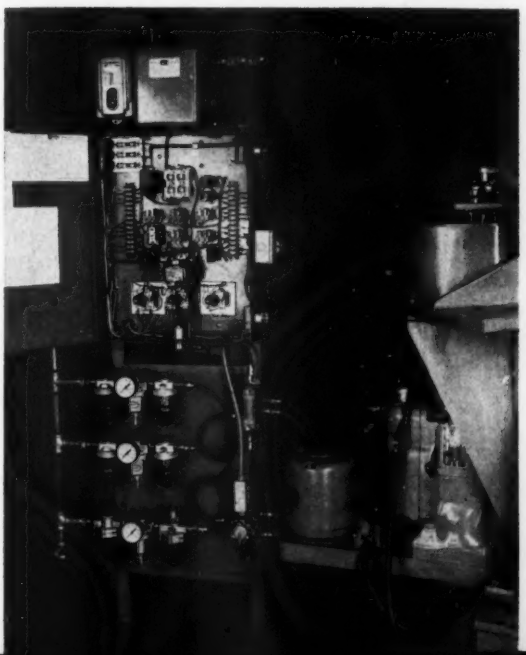
At station No. 5 the machining operation must again be accomplished from the bottom side of the fixture. This involves spotfacing three bosses and holding a decimal relation between all three.

A special bracket mounting a 19-400 Hartford drill unit and a three-spindle Ettco drill head is attached to the same inverted mounting bracket used in station four. The spotfacing tools are piloted in hardened bushings properly positioned in the holding fixture.

Immediately upon clearing station No. 5, the workpiece clamp is retracted during the index travel. Station No. 6 is idle.

Electrical interlock of index and machining sequence is accomplished through a single switch actuated by a cam that is mounted on the extended indexing camshaft provided on all Swanson chassis. The shaft completes one full revolution per index, assuring fool-proof starting of working stations at the completion of each index.

This machine is a good example of how the machine designer can, with proper fixturing and electrical controls, apply standard components to a standard indexing chassis and thereby create with a minimum of engineering and tool expense a machine that sharply reduces both production time and costs. end



The control panel contains the electrical components necessary to provide positive interlock of the various operations as well as the air valves and pressure regulators to all units. Placing these controls in a self-contained, remote unit offers greater ease of operation and maintenance without exposure to chips and coolant splash.

GIANT AIRFOIL MILL SHAPES COMPLEX PARTS

COMPLEX SHAPES OF AIRPLANE wings and twisted blades of axial flow air compressors, designed and used by the National Advisory Committee for Aeronautic's Ames Aeronautical Laboratory at Moffett Field, Calif., are literally sculptured in metal automatically on a huge 150-ton airfoil milling machine. The unique machine tool was developed and built to the government research center's requirements by Danly Machine Specialties, Inc. of Chicago.

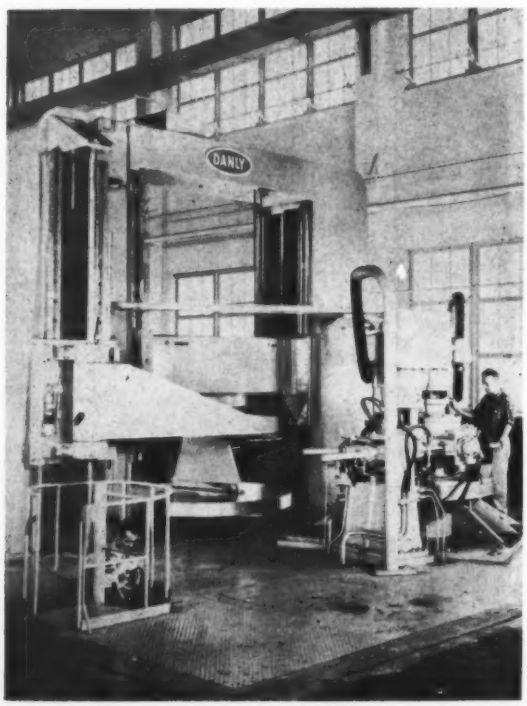
Parts produced by the advanced styled mill, as those of its smaller forerunners, are used as models in supersonic wind tunnel tests and as components of the tunnels themselves. The Danly mill at Ames Laboratory, for example, has been used to mill a series of blades now installed in the main drive compressors of several large wind tunnels at the Laboratory.

Primary advantage of this new machine, according to its manufacturer, is its ability to produce in one milling operation an airfoil shape of complex curvature at a fraction of the time and cost required to produce it by conventional machine tool and handwork methods.

Airfoil mills duplicate in metal a complex curved shape generated by tracing a prepared pattern. In this case, a wooden pattern is mounted vertically on a circular revolving table. Two large tracer wheels held in contact with the pattern transmit the relative motion to two cutters positioned against the metal blank, as the table revolves. Thus, the cutters shape the metal blank to the same curve as the wooden pattern.

Reportedly the largest mill of this type ever constructed, this new mill is fully automatic once the pattern and workpiece are positioned. It is capable of machining a shape 18″ x 18″ x 96″ long or 8″ x 26″ x 96″ long. The mechanism for holding the workpiece can exert an upward thrust of 8500 lbs. Both the pattern and the

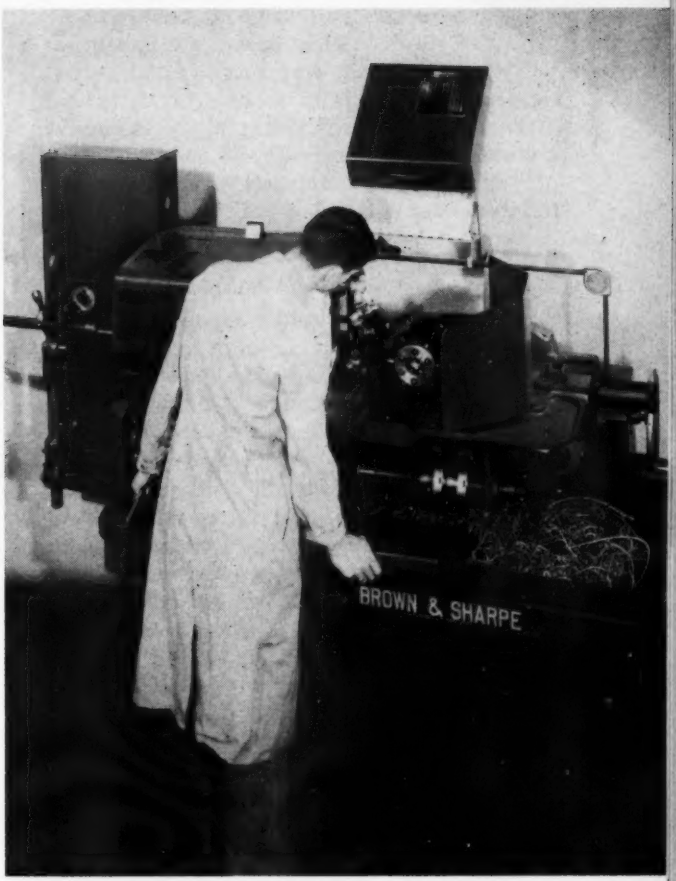
. . Continued on Page 114



A wooden master of a complex airfoil shape and follower wheels is shown on the revolving table in this above-the-floor view of the Airfoil Milling Machine at Ames Aeronautical Lab. Airfoil surface is generated by follower wheels through the hydraulic system to the set-up at right. Two opposing milling cutters machine airfoil shape in one pass on the revolving workpiece.

BROWN & SHARPE'S NO. 2 AUTOMATIC

Highly Productive for Precise Screw Machine Work



FOR TURNING, forming, and one-chip finishing, Brown & Sharpe's new No. 2 automatic screw machine promises to consistently hold limits to 0.0005". More efficient, faster, with higher sustained accuracy and reduced maintenance, it is available in three different capacities to take stock to ¾", 1¼", or 1½" dia.

A wide range of 18 high spindle speeds is available (16 on the 1½" spindle), with a top speed of 5050 rpm on the ¾" capacity spindle, 3500 rpm on the 1¼", and 2450 rpm on the 1½". For each high speed, 11 or 12 low speeds can be used in combination, in ratios from 2.2:1 to 15:1. This wide choice of combinations permits equally high cutting efficiency on materials ranging from tough alloy steel to free-cutting plastics, and on the widest range of work diameters. A real low speed in the high speed range is particularly advantageous when making parts from harder materials.

Selections of high spindle speed, low speed, and direction of low to high speed are all made by simple pick-off gears located in a single compartment. Spindle driving chains and sprockets remain untouched.

The spindle has a powerful, positive chain drive at all speeds, insuring delivery of required power throughout the full speed range for all operations within the tool capacity of the machine. The spindle is of the removable-unit, full antifriction bearing type, controlling end and radial play.

A wide range of production rates—1⅔ sec to 480 sec per piece — is obtained by only 11 change gears. When operations required to produce the part permit, more than one piece can be made per cycle. The No. 2's vertical slide has a quick-acting tool clamp. Holding the cut-off tool, it frees a cross slide for additional tooling. In addition, a positive stopping device can be set to automatically stop the driveshaft when the last piece is completed.

A rapid pull-out mechanism, incorporated with the turret, gives greatly increased production on deep drilling operations where it is desired to withdraw the drill several times to clear the hole.

The new No. 2 Automatic's combination of high speed, easy setup and operation, and low maintenance reportedly steps up overall efficiency by as much as one-third. end

A Short Cut to Mathematical Programming

VAM:

VOGEL'S APPROXIMATION METHOD

by Nyles V. Reinfeld
Managing Director
Executive Services

NATIONAL INSTITUTE
OF MANAGEMENT, INC.
Cleveland 14, Ohio

IF YOUR FIRST ENCOUNTER with Mathematical Programming was at the hands of a mathematician, you might very well have been tempted to substitute a D for the V in the title on the basis of its relationship. But the title is correct as given.

The three letters V-A-M stand for Vogel's Approximation Method. Mr. W. R. Vogel developed the VAM while working with me in setting up a training program in Mathematical Programming for the Federal Government.

The VAM is offered as a simplification and short cut over other methods currently in use.

The method is very simple to learn and is exceedingly fast compared to conventional methods of solution, making it very suitable to industrial adaptation. Whereas conventional methods of solution require formal training, the VAM can be learned in a matter of minutes, thus eliminating the bugaboo of mathematics found in industry.

Based on our experience, the VAM will give the best answer to applicable problems in about 80% of the cases. In the other 20%, it will usually give a very good approximation to the best answer. In these latter cases, it usually removes the "cream" of the savings to be obtained.

In addition, the VAM solution can be used as a starting point for applying conventional solutions reducing the total solution time to as much as one-fifth of that normally required.

Hence, the value of the VAM is two-fold:

1. It is easy to teach and has a quick-solution time.
2. With the solution obtained, you have a good point at which to apply more precise techniques, if the exact answer is required, again saving considerable computational time.

The problems to which the VAM applies are

Previous articles authored by Mr. Reinfeld that have been published by TOOLING & PRODUCTION are: "Do You Want Production or Profit?" (Linear Programming) in August 1954, and "The Principles of Inventory Management that lead to Higher Profits" in November and December 1956, and January 1957.

the typical transportation or distribution problems, which represent the bulk of all presently known applications of Mathematical Programming (MP). Many such problems exist in the normal traffic, production control, and inventory control activities of the average manufacturing establishment.

A Case Study

To illustrate the technique, let us take a look at an actual problem that was encountered at Joliet Arsenal. The problem deals with tractor-trailer movements and involves the distribution of 63 trailers to various locations for purposes of picking up loads for further distribution.

Rather than consider the complete problem here, we will only consider the problem of returning the trailers after they have been unloaded.

If a department is shipping 8 trailer loads out each day, then one requirement is that 8 empty trailers must be available at that department each day to pick up the loads. The Joliet problem was further complicated, as in industry, with the use of railroad shipments, thus upsetting the balance of shipments by trucks between buildings. In other words, it was possible to haul 15 trailer loads of material out of a building each day, while only bringing in 2 trailer loads each day. The other material needed at the building was supplied by rail.

The problem of getting empty trailers back for loading is formulated below in the "Trailer Return Table," Table I.

Along the top of the table are listed those departments and buildings that receive truck shipments daily and therefore will have empty trailers available **from** which to draw. The number of empty trailers that will become **available** during the day at a particular building is shown at the bottom of that column. For example, at Bldg. 64, 18 empty trailers will be available each day.

Along the left side of the table are listed those departments and buildings that make truck shipments daily and therefore need trailers delivered **to** them. The number of empty trailers **needed** during the day at a particular building is shown at the far right of that column. For example, Bldg. 66 will need 3 empty trailers each day.

The figure in each of the little squares represents the time (in hundredths of an hour, based on time study) to move an empty trailer **from** the building designated at the head of the column **to** the building designated at the left end of the row. (Because, in this example, the material being moved included ammunition, the distances between buildings were naturally fairly great.) The minus sign in front of the figures merely means that time is to be considered as costly, rather than profitable.

The problem, here formulated, represents a typical problem encountered in industry in which it is desired to reduce the total material handling time to a minimum.

Method of Solution

The subsequent tables in this section show the method of solution using the VAM. Please note that the VAM method of solution starts with the table in the form given by Table I and, by a series of repetitive cycles, gradually makes assignments (by rows and columns) until all needs are met. Each cycle involves a series of steps which are repeated in exactly the same manner until the answer is obtained.

In the example given here, seven cycles are required to get the final solution. The first three cycles are illustrated by Tables II, III, IV, and the last four cycles by Table V. (In actual practice, you would work with just one table and build upon it.)

To distinguish between the cycles, in each table a screen has been thrown behind the steps taken in that particular cycle. While you are first applying VAM or demonstrating it to someone else, it may be helpful for you to use a different color pencil for the action taken on each cycle. Thus: Red can be used for cycle 1, Blue for cycle 2, Black for cycle 3, Green for cycle 4, etc.

FROM / TO	1	3	64	27	NEEDED
27	-33	-25	-23	0	20
62N	-12	-26	-23	-20	7
62S	-10	-30	-20	-27	12
66	-45	-26	-50	-18	3
1	0	-24	-19	-33	7
3	-24	0	-22	-25	14
AVAILABLE	15	27	18	3	63 / 63

TABLE I
Trailer Return Table

	Col. 1	Col. 2	Col. 3	Col. 4		
	FROM / TO	1	3	64	27	NEEDED	Diff.
Row 1	27	-33	-25	-23	0	20	23
Row 2	62N	-12	-26	-23	-20	7	8
Row 3	62S	-10	-30	-20	-27	12	10
Row 4	66	-45	-26	-50	-18	3	8
Row 5	1	0	-24	-19	-33	7	19
Row 6	3	-24 X	0 (14)	-22 X	-25 X	14	22
	AVAILABLE	15	27	18	3	63 / 63	
		10	24	1	18	Difference	

TABLE II — Cycle 1
Trailer Return Table

In addition, each step within a cycle has been indicated by an appropriate symbol. These symbols are described in the step-by-step formulation below:

Steps Within the Cycles

Step 1 (Symbol: "Difference" column and row added to the basic table, as shown in Table II). For each row in the basic table, look at the time (cost) figures in that row and take the difference between the two smallest of these times. (If the problem were one that would provide for maximum profit, then positive figures would be used, in which case take the difference between the two highest profits.) Write this figure at the right of the row in the "difference" column.

For each column, look at the time-figures in that column and take the difference between the two smallest times (or two highest profits). Write this figure at the bottom of the column in the "difference" row.

Compute these differences for all rows and columns.

Step 2 (Symbol: □, a square enclosing a "difference" figure). Checking visually both row and column differences, select that difference which is greatest. The largest difference in cycle 1 of our example (see Table II) occurs in a column, and therefore the figure, 24, in the "difference" row is enclosed in a square.

Step 3 (Symbol: O, a circle enclosing a figure). In the column with the largest difference (24 in Table II), assign the **maximum** number of trailers to the lowest cost (or highest profit). This step is illustrated in Table II by 14. Note that the lowest cost in column two is zero, hence the assignment is to be made in the block that contains that zero. In other words, it costs nothing to move trailers **from** Bldg. 3 to Bldg. 3. But when we determine how much to assign, we must check to see how many trailers are **available** and how many are **needed** . . . in order to arrive at the number to be assigned. In cycle 1, we find that 27 trailers are available at Bldg. 3. Since we need 14 trailers at Bldg. 3, we assign 14 — entering that figure in the column and encircling it.

If the greatest "difference" as indicated by a square had occurred in a row instead of a column, the assignment would have been made to the block in that row with the lowest cost (or highest profit). Hence, the procedure in either case is the same.

Step 4 (Symbol: X). When we assign trailers as indicated in Step 3, we will use up all of the trailers (available or needed) in either a row or column. In Table II, the assignment of 14 trailers to column 2, row 6, takes care of the full needs of Bldg. 3 and no more trailers need be borrowed from any other point. Hence, we cross or x-out row 6, indicating that we have used up its capacity.

Succeeding Cycles

We are now ready to start cycle 2 and we follow exactly the same steps as those above.

The only change encountered is that the basic table is treated as existing of only those parts that are not x-d out (and we ignore the "difference" column and the "difference" row that we created on cycle 1). In other words, in our example, row 6 is not included in the calculation of differences for cycle 2. This will be true also in each subsequent cycle: Each time a row (or column) is crossed out, the differences are calculated only on the basis of the remaining parts of the table.

Table III shows the continuing process of what has gone before and also gives the steps used in the second cycle, as indicated by the screen background. A new "difference" column and a new "difference" row are constructed. In this case, the largest difference occurs in row one. Hence, 3 trailers are assigned to the cheapest cost (zero) in row 1. Three trailers use up all the capacity of column 4, so it is crossed out. Since 20 trailers are needed at Bldg. 27 and only 3 trailers are available there, we will have to transfer 17 more trailers to Bldg. 27 from some other point.

The differences for the third cycle will now be based upon the part of the table that has not been x-d out by the previous two cycles. The steps for the previous cycles and cycle 3 are shown in Table IV.

In cycle 3, the largest difference again occurs in a row. In fact, there is a tie between row 4 and row 5. Row 5 is selected because it has the lowest cost of the two tied rows. A number of rules have been developed for handling special cases of ties, but they will not be included here since this article is only intended to illustrate the simplicity and practicality of the technique.

The succeeding four cycles follow exactly the same pattern as that just illustrated and are given complete in Table V. Because the differences will normally change with each cycle, it is important that each cycle be completed before going on to the next. The simplicity of the procedure, however, is apparent and the actual time involved for large problems is not too great.

Recently, one problem involving a table of 37 columns and 13 rows was solved by Mr. R. W. Metzger of the GM Institute using the VAM. He estimated that, with proper application, problems of this size would take about two hours to solve by the VAM once the table was set up. The table given in our example, here, although similar, represents the total size of the problem worked on at Joliet. The figures are the original figures of the study that was initially made.

	Col. 1	Col. 2	Col. 3	Col. 4		Diff.	Diff.
FROM / TO	1	3	64	27	NEEDED		
Row 1 — 27	-33	-25	-23	0 (3)	20	23	23
Row 2 — 62N	-12	-26	-23	-20 ×	7	8	8
Row 3 — 62S	-10	-30	-20	-27 ×	12	10	10
Row 4 — 66	-45	-26	-50	-18 ×	3	8	8
Row 5 — 1	0	-24	-19	-33 ×	7	19	19
Row 6 — 3	-24 ×	0 (14)	-22 ×	-25 ×	14	22	None
AVAILABLE	15	27	18	3	63 / 63		
	10	24	1	18	Difference		
	10	1	1	18	Difference		

TABLE III — Cycle 2
Trailer Return Table

In cycle 5, we encounter something new. The greatest difference exists in row 2, where we need 7 trailers for Bldg. 62N. Since trailers from Bldg. 1 (column 1) would provide the least time factor (–12), we should draw from that point. However, running down column 1 we find that we have already assigned 7 trailers of the 15 available. We still have 8 left, of which 7 can be assigned to Bldg. 62N, writing the figure 7 in row 2, column 1.

Coming to cycle 6, the greatest difference exists in column 1. We need 12 trailers for Bldg. 62S (row 3), but only 1 trailer of those originally available in this column remains to be assigned. Therefore, we do not x-out the remaining squares in row 3, since we will still need 11 more trailers for Bldg. 62S.

After cycle 7, there are two blocks indicated by the heavy rectangle in the table to which no assignment has been made. Bldg. 27 still needs 17 trailers. Since all options with respect to the table have already been taken, there is no choice; we merely assign the remaining capacity to these two blocks as shown. Once this has been done, the answer so obtained is an optimum. In other words, no other method for handling these trailers would be better in terms of time.

Interpretation of the Solution

The solution says that since Bldg. 27 will have 3 trailers during the day, it will use these 3 trailers to fill part of its needs of 20 trailers a day. Bldg. 64 will send 7 of its 18 trailers to Bldg. 27 and 11 of them to Bldg. 62S, and so on.

The solution can be carried one step further by setting up routes showing the actual paths of loaded and empty trailers, if desirable. Such an extension permits a more accurate measurement of daily load in terms of tractors needed to haul the trailers, it permits a balancing of loads between drivers, and it permits a wide variation of sequencing so as to accommodate changes in schedule, delays in loading or unloading and priorities, without affecting the optimality of the end result.

Changes in the solution, reflecting change in the number of daily movements of trailers from building to building, can also be made in a matter of minutes.

Conclusion

The method of solution just discussed extends itself to solution of any type of Mathematical Programming problem which would be classified as a distribution problem. Since these types of problems represent a very high

		Col. 1	Col. 2	Col. 3	Col. 4				
	FROM / TO	1	3	64	27	NEEDED	Diff.	Diff.	Diff.
Row 1	27	-33	-25	-23	0 (3)	20	23	[23]	2
Row 2	62N	-12	-26	-23	-20 X	7	8	8	11
Row 3	62S	-10	-30	-20	-27 X	12	10	10	10
Row 4	66	-45	-26	-50	-18 X	3	8	8	19
Row 5	1	0 (7)	-24 X	-19 X	-33 X	7	19	19	[19]
Row 6	3	-24 X	0 (14)	-22 X	-25 X	14	22	None	None
	AVAILABLE	15	27	18	3	63 / 63			
		10	[24]	1	18	Difference			
		10	1	1	18	Difference			
		10	1	1	None	Difference			

TABLE IV — Cycle 3
Trailer Return Table

	FROM / TO	Col. 1	Col. 2	Col. 3	Col. 4	NEEDED	Diff.	Diff.	Diff.	Diff.	Diff.	Diff.	Diff.
Row 1	27	-33 ×	-25 (10)	-23 (7)	0 (3)	20	23	[23]	2	2	2	2	2
Row 2	62N	-12 (7)	-26 ×	-23 ×	-20 ×	7	8	8	11	11	[11]	None	None
Row 3	62S	-10 (1)	-30 ×	-20 (11)	-27 ×	12	10	10	10	10	10	10	[10]
Row 4	66	-45 ×	-26 (3)	-50 ×	-18 ×	3	8	8	19	[19]	None	None	None
Row 5	1	0 (7)	-24 ×	-19 ×	-33 ×	7	19	19	[19]	None	None	None	None
Row 6	3	-24 ×	0 (14)	-22 ×	-25 ×	14	22	None	None	None	None	None	None
	AVAILABLE	15	27	18	3	63 / 63							

10	[24]	1	18	Difference
10	1	1	18	Difference
10	1	1	None	Difference
2	1	3	None	Difference
2	1	3	None	Difference
[23]	5	3	None	Difference
None	5	3	None	Difference

This is the final solution and can be proved to be optimum mathematically.

TABLE V — Cycles 4, 5, 6, 7
Trailer Return Table

percentage of all Mathematical Programming problems, the VAM has a wide range of application.

The problem selected here does not illustrate all facets of the VAM. Special consideration must be given to ties and other analoguous situations for which a number of rules have been devised.

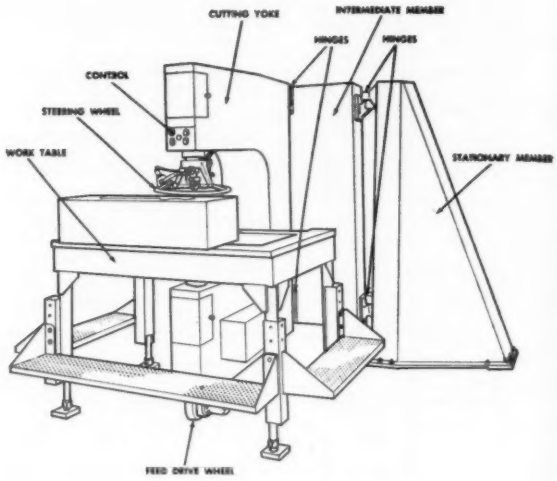
Again it should be noted that the method is an approximation and does **not** guarantee the best answer. The answers obtained are best in about 80% or more of the problems encountered so far. Sometimes, it is necessary to "polish" off the solution by use of some of the more sophisticated mathematical techniques currently in use in the field. However, even when the "polishing" is felt to be necessary, the VAM offers a short cut and solution-time savings of considerable value. When the VAM solution is best, it can be checked mathematically in a matter of minutes.

Mr. Bert Kassing of the Nekoosa-Edwards Paper Company, in discussing one of his problems, estimated that the VAM took about one-fiftieth of the time normally required by experienced persons with the mathematical method known as the MODI (Modified Distribution Method), the method most frequently used.

Because of its simplicity, we believe that the VAM will do much to foster the spread of Mathematical Programming into industry by making it a tool that everyone can use without a great deal of extensive study. In addition, it will make MP practical in those situations where time is an important factor and a computer is not a personal piece of equipment.

end

NEW CONCEPT IN CONTOUR MACHINING - - WORK STATIONARY, TOOL MOVES



Construction details of DoAll's new contour sawing machine.

A NEW CONTOUR sawing machine has been developed that is based on the premise — when a workpiece is heavy, ungainly, or unbalanced, it is easier to move the tool than to move the workpiece.

By fully utilizing this premise, The DoAll Company has designed their Model 5 contour band machine that has a work capacity of 70 sq ft and is capable of taking a straight cut 14.5' long.

It will find wide application in the air frame and shipbuilding industries where the machining of large intricate contours are regularly required.

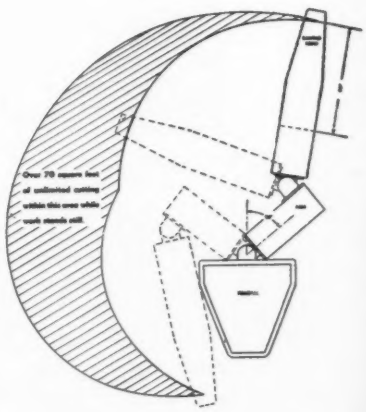
Phantom view of the Model 5 contour machine showing countershaft linking saw guides to the power feed wheel.

The work for which the Model 5 is most ideally suited, however, is the machining of large dies.

This machine achieves its extreme range and ease of handling by means of an articulated construction. The cutting and guiding mechanism is carried by a yoke, housing all the necessary parts for the cutting and the power feed. The yoke is fabricated of aluminum to reduce its inertia. Between the yoke and the stationary member which is fastened to the floor is an intermediate member. These three members are connected by hinges using anti-friction bearings. This design permits the saw blade to move within a 70 sq ft area and to make a straight cut 14.5' long.

As seen in the phantom view, the yoke houses a complete 4-wheel variable speed band machine. The upper and lower saw blade guides are mounted on tubular posts through which the saw blade travels. Both posts telescope to permit adjustment for work thickness. The posts carrying the saw blade guides, together with the power feed wheel, are connected to a countershaft by means of sprockets and chains. Any movement of the top post is thereby transmitted to the bottom post and to the feed wheel.

The hand-wheel connected to the top post permits the operator to twist the saw blade 180° in either direction. The maximum twist in either direction is determined by the maximum twisting stress which varies with available band size. Turning the handwheel turns the lower feed wheel at the same time the blade is turned. The power feed wheel is a rubber-tired wheel that is driven by a torque motor and causes the entire yoke to move in the direction that the saw blade is pointed.



Development of yoke and arm travel for the new DoAll contour machine, showing the large work area covering 70 sq ft.

The force of the feed is controlled by a rheostat; and the wheel may be raised by means of an air cylinder so that the cutting head may be swung freely when desired. Also included in the yoke, but not shown in the phantom views are the hydraulic motors driving the two bottom band wheels, work light, etc. end

Critical dimensions are held within close tolerances and, upon inspection, the parts are marked for selective assembly. High production machines are used for major operations and great care is exercised to remove burrs and to flush out all foreign matter.

High Production Machining and Testing of Hydraulic Valves

by C. E. Schultheis
General Superintendent
West Pullman Works
INTERNATIONAL HARVESTER COMPANY
West Pullman, Illinois

RECENT INCREASES in the use of hydraulic equipment, especially in agricultural applications, have made it expedient for the West Pullman Works of International Harvester Company, Chicago, to install completely new equipment for the quantity manufacture of cast iron hydraulic valves. These valves carry high pressures and require that parts be accurately machined to meet exacting service requirements.

The iron bodies are cast to a roughly rectangular shape and all six faces have to be machined flat in initial operations. Subsequently, holes and seats are machined to close limits. After assembly of moving parts, high pressure tests are required to insure that the valves will perform properly in service.

For the initial operation, body castings are placed by hand in the recesses of a heavy

Fig. 1. Roughing of the two narrower parallel outside faces of each valve body is done with carbide cutters as the castings are advanced in this rotary fixture. A chain looped around the fixture locks the castings securely.

Fig. 2. Fixtures in which the two larger side faces of the valve housing are rough and finish ground when advanced under the two horizontal wheels of a Blanchard grinder. The castings are turned over and loaded in alternate fixtures between passes.

spider fixture rotating in a vertical plane in a Davis-Thompson machine, as shown in Figure 1. As the fixture turns continuously, it carries the castings between opposed carbide cutters that remove 1/8″ to 3/16″ of metal from two parallel vertical faces.

Loading and unloading are done by hand but clamping is by a chain looped around the fixture and is automatic. Two identical machines, but having fixtures altered to suit, face two other parallel faces and two end faces respectively, these four faces being at right angles to the first pair. Thus the three machines produce three pairs of mutually perpendicular parallel faces, thereby "squaring" the casting with roughing cuts.

Each casting then goes to the Blanchard surface grinder, Figure 2, where the two widest faces are ground in fixtures on a circular table by two horizontal wheels that remove, together, 0.007″ of metal per side. Each face is fed under both wheels. In the first pass, one face is rough and finish ground and, in the second pass, the same is done on the opposie face. There are two sets of fixtures placed alternately, one set being used for the first pass and the second set, which is slightly higher, is loaded from the first fixtures for the second pass. It requires one of these grinders to keep pace with the line.

Many of the holes and recesses in the casting are produced and machined in the 54-spindle, six-station indexing LeMaire machine, a portion of which appears in Figure 3. This has fixtures that hold four castings at each station, the four being loaded and unloaded by hand at the operator's station. Clamping and all machining operations are automatic, the latter including drilling, reaming, counterboring and tapping.

There are two heads at some stations. Some spindles are vertical and some are horizontal, the last station having six high speed taps. Total output is 32 castings an hour, these being regulator bodies which are similar to valve bodies but differ in certain details.

The valve bodies go to another LeMaire machine, a three-station indexing machine that has 16 vertical spindles and holds two pieces per station. In the first cycle on each piece, machining is done from one side only. Each piece that has been through the first cycle is turned over before passing through the second

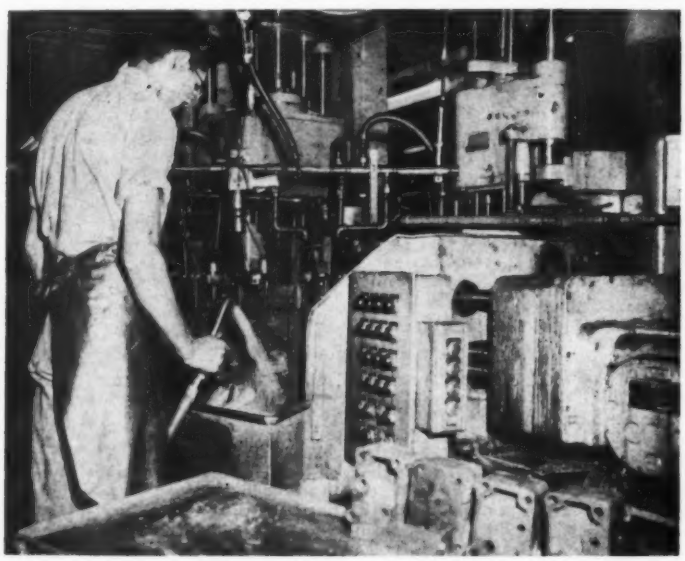


Fig. 3. One of several LeMaire machines that produces holes and recesses in the castings. Each fixture holds four castings that are processed simultaneously at each of five stations. Cutting tools are driven by 54 spindles, some vertical and some horizontal.

Fig. 4. In this machine, having 64 horizontal spindles, the vertical fixture indexes through nine working stations. Tools are advanced from each side. Each casting is turned over before making the second of two circuits through the machine.

cycle, so one piece is finished, a new one is loaded and one is turned over each time the fixtures stop at the loading-unloading station. Operations include drilling, reaming and counterboring. Output is 65 castings an hour.

In a third LeMaire machine, Figure 4, a fixture that indexes in a vertical plane is used and passes through one load-unload station and nine working stations. There are 64 horizontal spindles coming in from one side or the other. Drilling, reaming, tapping and counterboring are done during these indexes.

After making the first circuit, the piece is turned over for a second circuit, the loading, unloading, turnover and clamping being done by hand. Output is 85 pieces an hour. The tapping spindles are fed by lead screws. Some tools are high speed steel and are changed each 2,400 pieces. Others are carbide and are changed for each 4,800 pieces.

On this machine, there is an automatic shutdown after each 2,400 complete cycles and the machine cannot be started again until remote control is reset. This is intended to avoid making too many cuts per grind, hence possible trouble from cuts made with dull tools and the likelihood of tool breakage.

Work in the machine just mentioned nearly completes the major machine operations but a few others, chiefly of the finishing type, are done as described below. Before these, however, the castings are washed and then blown out with air, in an automatic washing machine, to remove chips and foreign matter.

Castings then go to a Heald Borematic machine where tools in four spindles step bore precision holes in two pieces at a time at the rate of 65 an hour, holding 0.996″ - 0.997″ limits. Next, an undercut ¼″ wide and ⅛″ deep is produced in a machine, Figure 5, of I H C design, using Kingsbury heads. A special cam and spring on the tool holder give the undercut's radial feed to a carbide tool.

Then a second special I H C designed machine bores two off-center holes. One operator tends both machines and processes 500 castings per 8-hr. shift. This off-center drilling causes an unfavorable break-through but a carbide tool does the job without difficulty. An air operated drill is then used to produce a small cross hole that enters one side of another larger hole already drilled.

Fig. 5. Special I H C designed machine that makes an undercut when its tool is fed radially by a cam. A second special I H C designed machine is tended by the same operator.

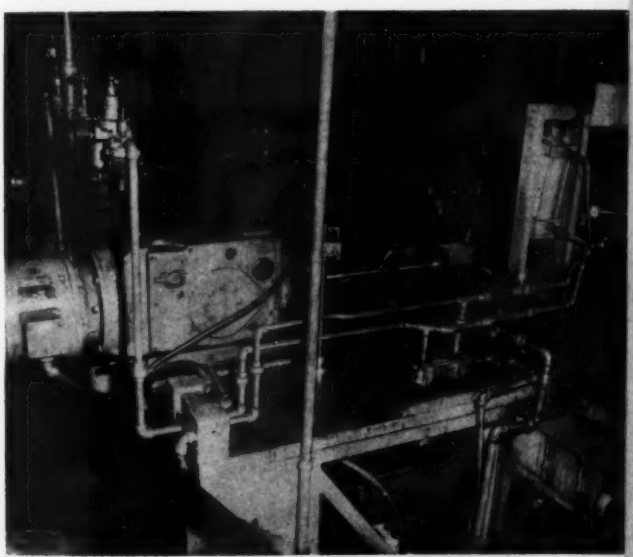


Fig. 6. One of the final operations is to hone the valve hole in this Micromatic machine; the hole being held within 0.0003″ limits on diameter. Air gages check this dimension and the hole size variations in tenths are marked on each piece for selective assembly.

Three air nozzles in a special fixture, each controlled by a relay valve, are used to blow out each casting. Deburring is then done in one hole by a standard reamer after which four brushes, each of different size, are run through reamed holes to loosen any fine burrs.

Four faces of the casting are then given a light cleaning on an abrasive belt with the casting held by hand, after which the castings are passed through another washer that uses an alkali solution in the first stage and soluble oil heated 180°F in the second stage. This wash is followed by an air blowout and by a careful visual inspection of all holes, using a small light inside each casting, to insure that no burrs or dirt particles remain.

Five pins, each hardened and ground, are then pressed into holes 0.002″ to 0.005″ smaller than the pins, by means of a special machine, to seal these holes permanently. Each casting is then subjected to air pressure at 80 psi and is submerged for 15 seconds in mineral oil to detect any leaks.

Each casting then has its spool valve hole finished in the Microhone machine of Figure 6. Size is checked with an air gage and is held within 0.0003″ of specified size. The castings are marked with the number of tenths variation from basic for selective fit with valves similarly marked. Valve selection is such as to provide a clearance of 0.0004″ between the valve and the hole. Valves are hardened, and ground between centers, the standard finish size being 0.9995″. This diameter is checked by an air gage with the valve supported on lapped carbide rolls.

Castings and valve shafts are cleaned in a special I H C designed flushing machine, Figure 7, just prior to final assembly operations.

Other valve components are produced with equal care and assembly is done in special fixtures with whatever special checks are needed during the process. Checks of the final assembly are most exacting and are conducted with such thoroughness as to insure excellent service performance.

end

Fig. 7. Flushing and cleaning of castings and valve shaft with filtered oleum under presure to remove all dirt and foreign matter is done in this setup.

Cincinnati Filmatic Nos. 0 2 3 4 5 6 Centerless

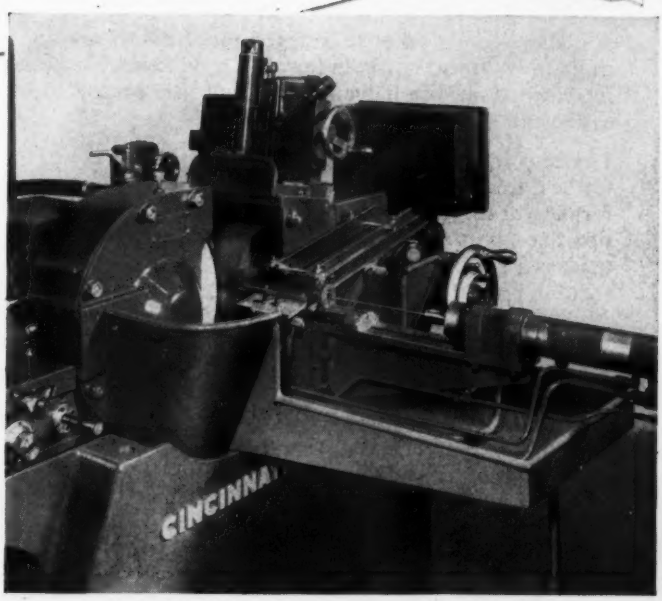
The No. 0 is the machine for this job . . . grinding diameter and back taper on small drills

Low, low cost of machining operations is essential for competitive pricing of small drills ranging in size from No. 60 to ¼" diameter. One manufacturer does an excellent job by grinding the diameter and back taper on CINCINNATI® FILMATIC No. 0 Centerless Grinders.

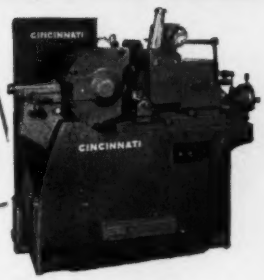
The machine operates at a very high rate of production, grinding 16 drills per minute (768 per hour at 80% operating efficiency) to high standards of quality and at negligible cost.

You'll want to know why the No. 0 . . . one of six sizes of Cincinnati's line of standard Centerless Grinders . . . does such a fine job of grinding small parts. Spindle bearings are the exclusive FILMATIC type that never wear out; lubrication is automatic; regulating wheel speeds are infinitely variable; 5 hp drive; readily automated. Capacity: up to ½" diameter. Want more information? Look in Sweet's Machine Tool File, or write for a copy of catalog No. G-640-1.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



CINCINNATI FILMATIC No. 0 CENTERLESS GRINDING MACHINE
CATALOG No. G-640-1



CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE • GRINDING MACHINES • CHUCKING GRINDERS
MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 105

LINDBERG INDUCTION UNIT IMPROVES HEAT TREATING PROCESSES AT J.I. CASE...

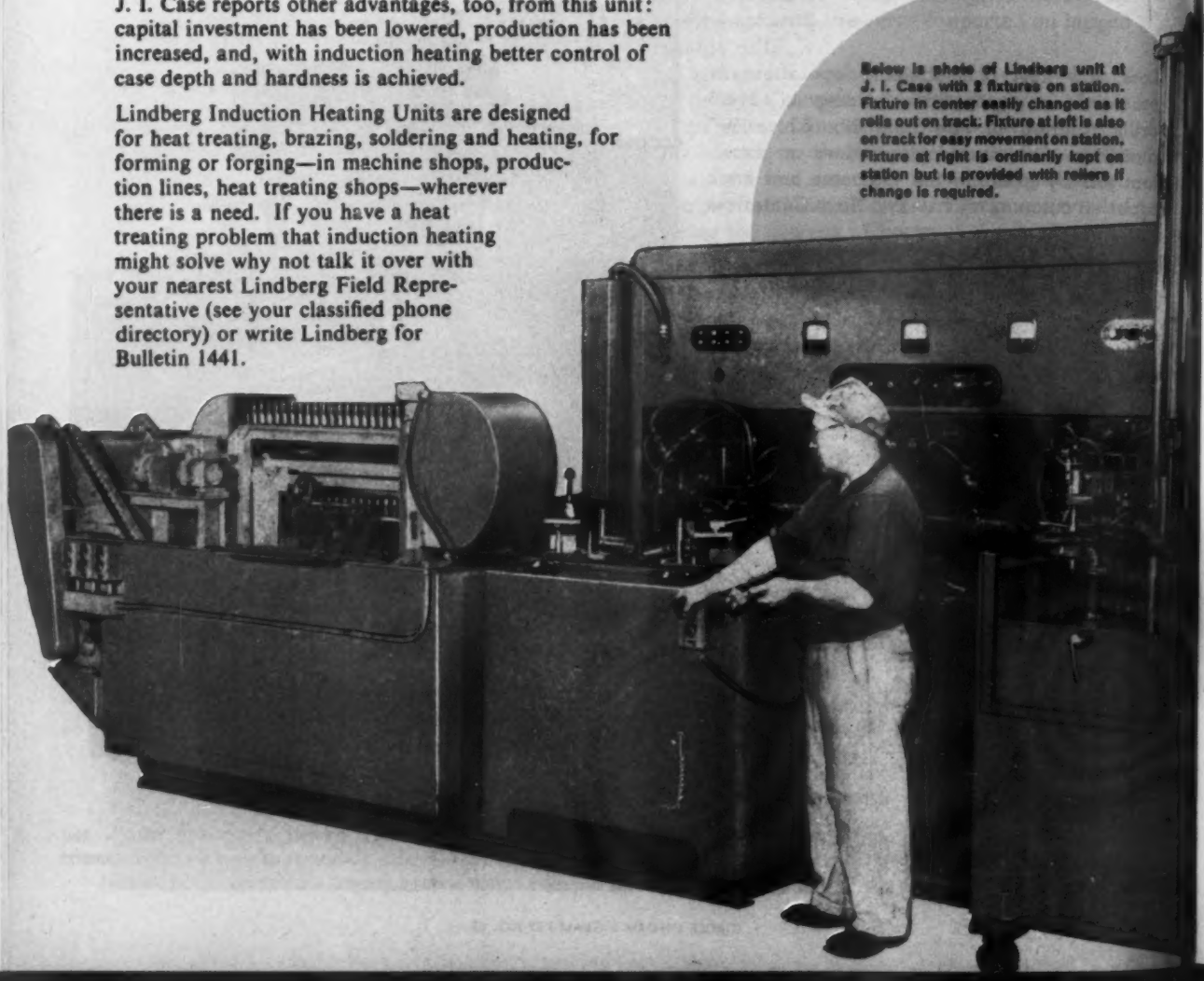
SAVES ½ ITS TOTAL COST— IN 1 YEAR!

A single Lindberg 2-station High Frequency Induction Heating Unit at J. I. Case Co., Racine, Wisc., is providing a happy combination of sizeable cost savings and improved quality and production efficiency in heat treating parts for Case tractors. Actually, the dollar savings effected with this Lindberg unit will repay its total original cost in *less than 2 years!*

This single unit and the five work fixtures provided with it, working on 2 to 3 shifts, 5 days a week to meet production requirements, heat treat some 63 separate tractor parts. Work fixtures are readily changeable, set-up time is materially reduced, and because of the 2-station design, the unit can operate continuously while work fixture is being changed over on one station.

J. I. Case reports other advantages, too, from this unit: capital investment has been lowered, production has been increased, and, with induction heating better control of case depth and hardness is achieved.

Lindberg Induction Heating Units are designed for heat treating, brazing, soldering and heating, for forming or forging—in machine shops, production lines, heat treating shops—wherever there is a need. If you have a heat treating problem that induction heating might solve why not talk it over with your nearest Lindberg Field Representative (see your classified phone directory) or write Lindberg for Bulletin 1441.



Below is photo of Lindberg unit at J. I. Case with 2 fixtures on station. Fixture in center easily changed as it rolls out on track. Fixture at left is also on track for easy movement on station. Fixture at right is ordinarily kept on station but is provided with rollers if change is required.

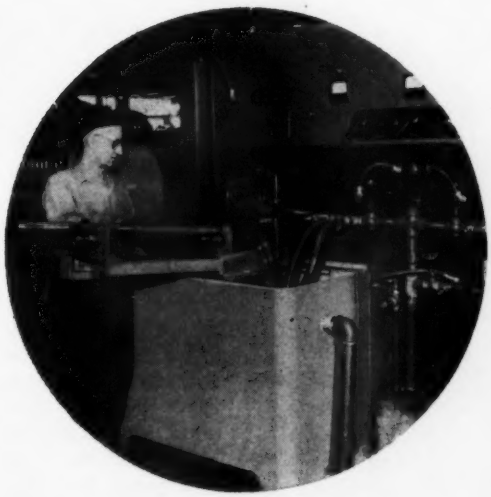
(Above) Hydraulic male coupling is being treated on this fixture. 3 other parts are treated by it, too.

(Above) This shows fixture handling inlet and exhaust valve rocker arms. Same fixture treats 6 other parts.

(Above) This fixture is selectively hardening pads and slots on shifter forks. It is also used for treating 17 other parts.

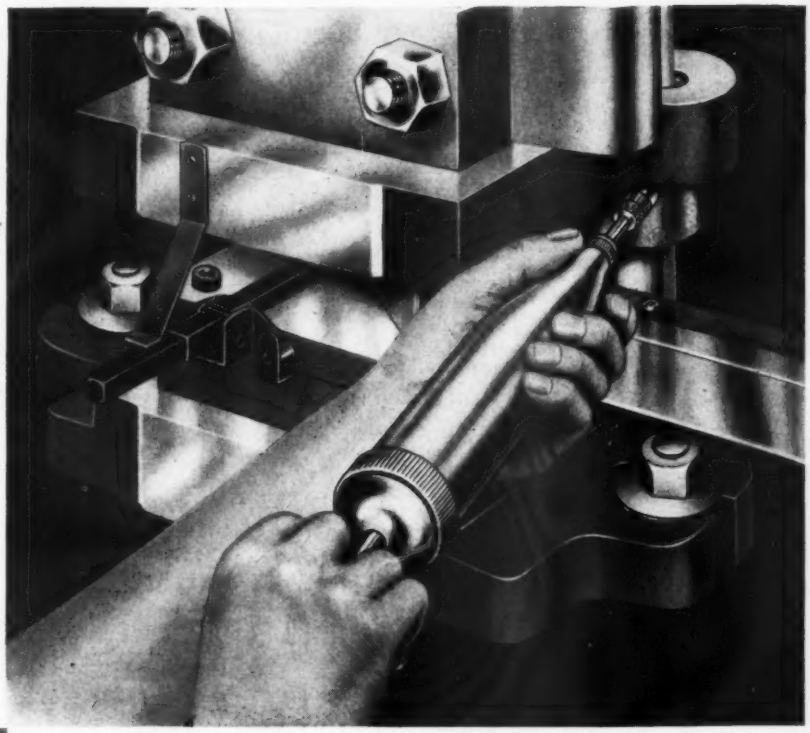
(Below) This fixture is shown selectively hardening a front axle king pin. It handles piece up to 45¼" long, 35" of which can be scanned to desired depth. It is also used for 34 other parts.

(Below) Power take-off hydraulic drive shafts are one of the 3 parts treated by this fixture.



LINDBERG
HIGH FREQUENCY DIVISION
Lindberg Engineering Company
2445 West Hubbard St., Chicago 12, Ill.

NEW oil lubrication system



ON NEW DANLY DIE SETS

Here is another example of Danly leadership in die set design . . . the new oil lubrication system for guide posts and bushings. The illustration shows how easily a lubrication gun reaches the oil fitting in the shoulder of the bushing. Once injected, oil fills figure-8 oil grooves in the bushing to assure uniform lubrication for protection that lasts even through long press runs . . . less frequent oiling is needed, the job is done faster. Isn't this new lubrication system another important reason why you should specify Danly die sets?

Leading industrial distributors and Danly branch assembly plants—located in all major tooling centers—stock Danly Die Sets for fast delivery.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue • Chicago 50 • Illinois

CIRCLE INFORM-A-GRAM KEY NO. 108

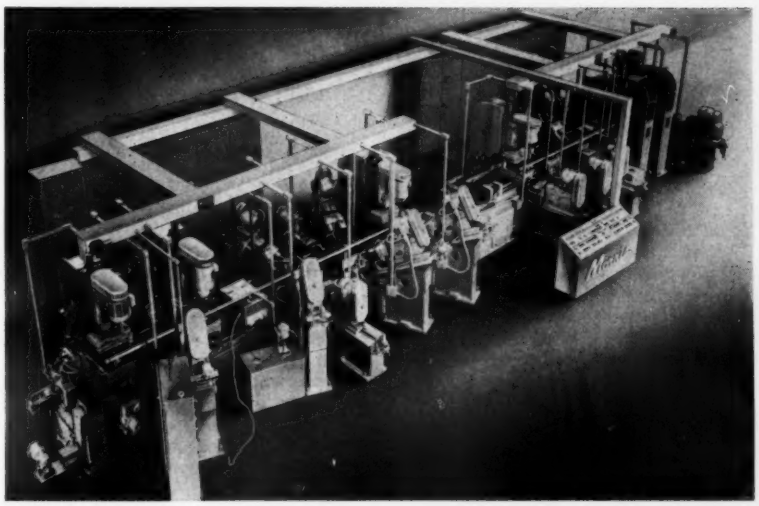
Special Machines

TRANSFER MACHINE PERFORMS 90 OPERATIONS

A new in-line transfer type high production machine that automatically completes one part every 7½ sec has just been designed for a leading automotive manufacturer to produce 2 and 4-barrel carburetor bodies.

The machine, manufactured by The Morris Machine Tool Company, incorporates Morris standard production units. 14-#1 Cam-matic, 7-#2 Cam-matic, and 4 Air-Oil-Matic drill units are used. They perform 31 drilling, 19 boring, 10 reaming, 4 gaging, 13 probing and 13 tapping operations — a total of 90 operations, involving 56 stations, and processing 480 parts/hr.

Its automatic features include an automatic loading section, that checks parts and rejects those in improper position. Precision locator holes are drilled and gaged for accuracy at the first station.



Both first and second sections may be operated either individually or as a single unit. Automatic loading and unloading is provided in the center section, where automatic storage also may be provided. After machining, there is automatic delivery of parts to the unloading conveyor. Drill units are mounted on power driven sliding sub-bases to facilitate tool changing.

Morris "unit-type" construction produces a special machine from standard units, at considerable savings. An additional advantage is fast, easy realignment for product model changes, for completely new models, or for other type products within its mechanical size limitations.

PROCESSING ONE CASTING PRODUCES FIVE BEARING CAPS

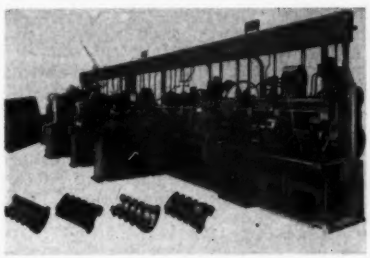
From a single casting, a fully automated, 20-station machine produces a complete set of 5 finished bearing caps for V-8 engines. Handling 90 castings/hr, it produces 450 finished caps/hr.

The machine, developed by LaSalle Tool, Inc., is sectionalized to make it easier to build, easier to install, and easier to locate. This feature enables the handling of future model changes with the minimum expenditure of either time or money for re-tooling.

The LaSalle Bearing-cap-amatic is built to J.I.C. hydraulic and electric standards. It is entirely automatic in its operation, with automatic lubrication, a built-in coolant system manifolded to each tool, and an automatic chip conveyor.

The castings handled by this unit are really clusters of bearing caps. Prior to the machining operation, the joint face, channel fit, and the half round have been broached to furnish locating surfaces.

The castings are fed into the machine automatically by a shuttle-type load conveyor, with the joint face down, and the No. 5 bearing cap in the lead. They then proceed through all 20 stations, automatically. At the



19th station all machining operations are completed. At this point 4 slots are milled through the bearing cluster which divides it into 5 separate bearing caps. At the 20th station the 5 bearing caps are unloaded.

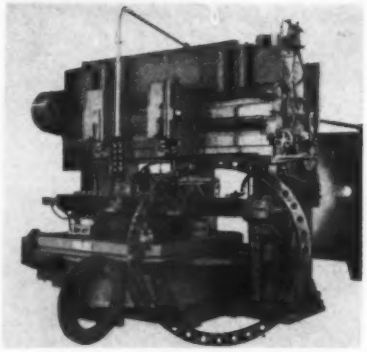
AUTOMATED DRILLING ON WIDE RANGE OF BOLT CIRCLE DIAMETERS

Bolt circles from 12" to 100" dia are drilled by this Moline Model HD68 machine.

Each of the two spindle heads has capacity for a 2½" dia drill in steel. Each spindle also has quick 2-speed adjustment which, together with the variable speed d-c spindle drive motor, permits a total rpm range of 9 to 1. An indicating tachometer shows spindle rpm. Hydraulic power moves the rail carrying the spindles at rapid traverse and feed rates on vertical ways. Motor driven screw with hand wheel for close adjustment is provided for setting the center distance between spindles.

The hydraulic-powered, rotating table provides automatic indexing for 30 different totals of holes on a bolt circle. Drill guide bushings are used for spotting holes to full diameter after which the drills are withdrawn from the bushings and the bushings are moved out of the way before the drills are fed through the work. The hydraulic feed rate is adjustable and also can be set for a steady rate of advance or for step

Special Machines



drilling if required for deep holes. All of these functions are combined in an automatic operating cycle.

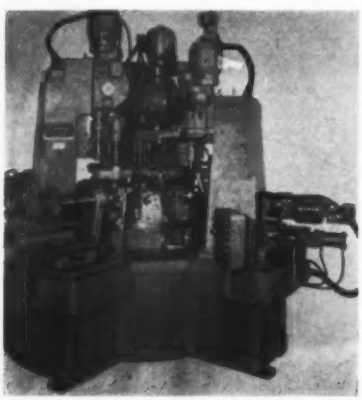
When a workpiece is to be loaded or unloaded from the clamping vises on the table, the drill bushing support can be raised up out of the way by electric pushbutton controlled hydraulic power. After the work is clamped in place and the bushing support is returned to working position, the "cycle start" button is used to initiate a complete automatic operating sequence which ends when the predetermined number of holes in a bolt circle has been drilled.

SIX STATION INDEXING MACHINE EMPLOYS CAM FEED DRILLING UNITS

This six station horizontal indexing, drilling and boring machine is used to hone, face, hollow mill, drill and tap three different cast iron gear housings.

The machine, produced by The Hartford Special Machinery Co., employs five cam feed drilling units and two lead screw tapping units to process the parts. Horizontal units are provided with side adjustment to handle left hand parts. The loading fixture consists of interchangeable manually clamping nests.

Production is 256 parts/hr at 100% efficiency.



A Plan for Safer Plants

Management's Role and Responsibility

First of a series prepared with the cooperation of the Greater Cleveland Safety Council

A HIGHLY-ORGANIZED Safety Department means nothing in terms of plant safety if everyone in the plant — from company president through all levels of supervision, to the men on the production lines — is allowed to become lax about his responsibilities toward his company, his fellow workers, and himself. The same reasoning applies to smaller shops where it is impractical to have a special Safety Department: Each man must remember his responsibilities.

By the same token, it shouldn't take a serious accident to make a plant "safety conscious." Nor should it take an accident to point up the necessity of having some kind of organized plant safety program.

Safety directors tell us that injuries are the result of either hazards or unsafe acts. Hazards cannot be eliminated, but they can be reduced. Unsafe acts on the part of the employee, however, can and must be eliminated.

Chances are that workers commit many unsafe acts before receiving an injury. For instance, machine operators may fail to wear their safety goggles for weeks on end. The foreman notices this, but doesn't do anything about it. When the day comes that Joe Machinist gets a chip in his eye because of his failure to wear the goggles, it will be too late to eliminate the unsafe act which has been in evidence for some time. This is wrong.

To understand safety responsibilities and techniques for preventing injuries, the Greater Cleveland Safety Council, in its "Patterns for Progress" program, points out that many of the factors contributing to injury occurrence or prevention are solely in the hands of management. For example:

- Management provides the place to work. If the place is crowded, congested, in a hazardous location, etc., personal injuries are likely to occur.
- Management provides and maintains the work facilities. If unsafe tools, equipment, layout and materials are provided or if tools, equipment, layout, or surroundings are not maintained in a safe condition, personal injuries are likely to occur.
- Management selects, hires, and places the workers. If the workers selected are physically and mentally unable to do the work required, personal injuries are likely to occur.
- Management trains the workers. If no training and education, or inadequate training and education, are given to workers, personal injuries are likely to occur.

The worker has no responsibilities for these four points, so, the Council reasons, if injuries are to be prevented, the initial action must come from the management. They call upon every supervisor in the organization to accept this fact, and do something about it.

An injury prevention program will only be successful when it is recognized as a management function, and management teaches its workers to observe safety rules and makes the whole organization safety conscious.

Watch for . . .

- Use of defective tools, or unsafe use of tools.
- Unnecessary exposure to danger.
- Overloading, crowding, poor arrangement.
- Failure to use safety or protective devices.
- Working on moving or dangerous equipment.
- Operating or working at unsafe speeds.
- Operation of equipment without authority or proper clearance.
- Distracting attention, teasing, horseplay.
- Making safety devices inoperative.

(As listed by the National Safety Council in ACCIDENT FACTS, 1956 Edition.)

Automatic Skin Drilling Machine

To replace costly, slow hand methods, Grumman Aircraft Corporation designed and fabricated the "skin drilling machine" shown here.

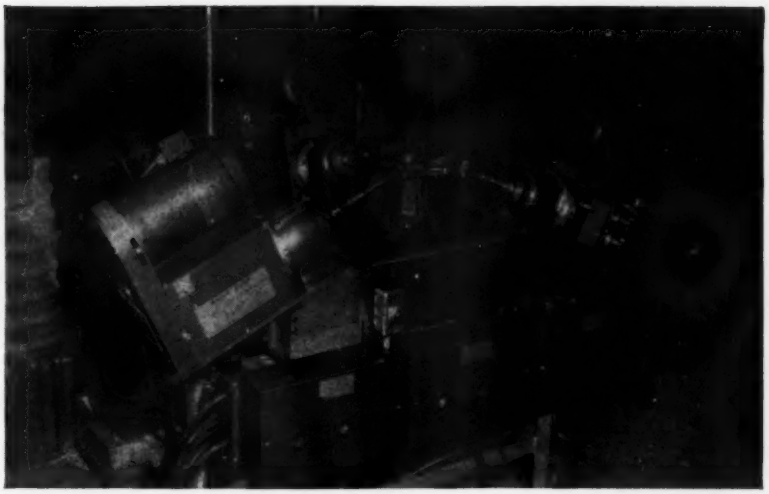
The production requirement was—9000 holes in aircraft skin assemblies consisting of aluminum corrugated section and skin. Formerly, all holes were predrilled by hand in the corrugations and then transfer drilled into the skin. Now, hand work is reduced to tack riveting skin and corrugation and for a few inaccessible areas.

Operation

This new machine clamps the workpiece to prevent burring, drills #40 holes usually 5/8" apart and indexes automatically to next position. A chain and sprocket 1 H.P. drive, regulated by template and photo-electric controls, moves the drill head and lower ram assembly along parallel rails from hole to hole. The workpiece remains stationary. Row on row indexing is done by an air driven gear and rack assembly. 50 to 55 holes per minute, or about four hours per assembly, are now achieved.

Savings

In addition to the remarkably high time savings of 7½ hours per workpiece, other benefits include reduced jig time and number of jigs, extended drill life and the elimination of operator strain. The drill head used is a Dumore 20-011, self-contained with a rotary vane compressor. This is but one of the many automatic drill units made by Dumore for automation purposes. For complete information, write The Dumore Company, 1304 Seventeenth Street, Racine, Wisconsin. ADV.



Drill and Tap Automatically with this 2-in-1 Tool

the New DUMORE Series 28 "DRILL-N-TAP" UNIT

Saves Set-Up, Fixture and Service Costs

One of the world's largest farm implement makers, Massey-Harris-Ferguson, uses three new Dumore "Drill-N-Tap" Units to cut costs and increase production on power take-off housings. These units *automatically drill and tap* three holes in two sizes of housings without changing position on the same set-up. A 1"-thick steel plate is placed under the smaller housings for aligning to proper position. Here, the drilling and tapping are done on the same fixture. Drill bushings are simply removed when tapping. *Tap fits into chuck—no extra tapping head is required!*

The Dumore "Drill-N-Tap" Unit is a *driller* and a *tapper* — all in the same automatic machine. Two tools in one — at the cost of only one!

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An open letter

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Telephone 4-0476

TO PRODUCTION MEN INVOLVED IN TOOLING:

You are invited to call on the experience of Punch Products' Engineers, who have personally accumulated over 90 years of know how" in the field of Unitized Tooling, to recommend the most efficient and economical method of producing punched or notched parts.

Many leading manufacturers have taken advantage of this personalized engineering by calling in our experienced personnel or sending us part prints for analysing their complete tooling program ---- large or small. From this information, we submit comparative cost charts showing the savings produced by UNIPUNCH Tooling over present methods. In many cases, the savings more than pay for UNIPUNCH Tooling during the first production run.

You, too, will know how much you save before you go into production --- even before you invest in UNIPUNCH Equipment --- by sending us a set of part prints for our recommendations and cost analysis. No obligation, of course.

Your inquiry will receive my immediate attention.

Very truly yours,

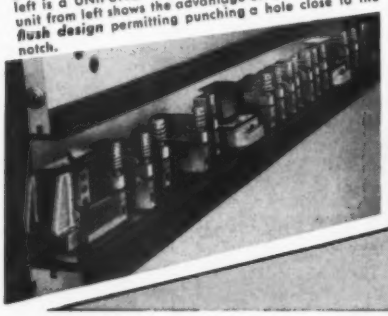
Jerome F.Ferdinand
Sales Manager

PUNCHING, MARKING, NOTCHING AND FORMING

Showing three-stage, pass along, set-up which is template mounted on a #5100 Unipunch Bed Rail. First operation, beginning at right, punches 2 holes and numbers part. Second operation punches 3 holes and notches 2 corners. Third operation forms part. Note samples on ram.

Showing set-up of combination hole-punching and notching with finished work piece in foreground. Series A Units punch and notch material from shim stock to ¼" thick.

Set-up of UNIPUNCH Series A Hole-Punching and Corner Notching Units on a strip template mounted on a #5000 bed rail in a press brake. The seventh Unit from left is a UNIPUNCH Edge Notching Unit. The second unit from left shows the advantage of UNINOTCH Unit flush design permitting punching a hole close to the notch.



UNIPUNCH

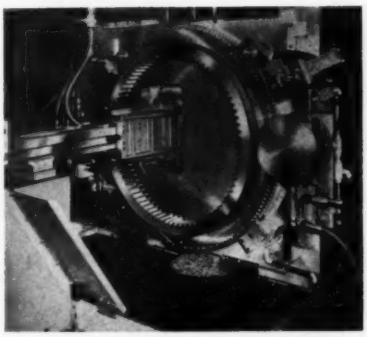
PUNCH PRODUCTS Corporation

HORIZONTAL BROACHING MACHINES FIXTURED FOR OVERSIZE GEARS

A universal horizontal-broaching machine has been built and fixtured to accept the huge gears required by equipment vital to the national road-building program. The machines broach either finished spur or semi-finished helical gears in a range of sizes up to 42"PD.

These machines, built by Colonial Broach & Machine Company, are also considered particularly applicable to the gear cutting needs of builders of marine equipment, big presses, heavy materials-handling devices, and earthmoving equipment.

Set up to cut a Tournapull tractor steering gear for LeTourneau-Westinghouse, the machine reduced the tooth cutting time from an all-day job to 1½ hr. This includes 10 min for loading and unloading and 10 min for reversing the broach. In this application, three parts are broached: a 65-tooth gear having a helix of 20° and a 32.5" PD with a length of cut of 4.5"; a 79-tooth helical gear with a 26.33" PD and a length of cut of 4.5"; and a 84-tooth straight spur gear having a 42" PD and a length of cut of 4.37".



The steering gear is clamped to the face plate, which also holds the master indexing gear. Automatic shuttle and automatic indexing is hydraulically actuated from a pin against a gear tooth pawl. The gears are broached in two passes — a roughing cut and a finishing cut. Subsequent shaving or grinding operations are unnecessary for the spur gears. A special angle plate bolted to the machine face is used for semi-finishing the helical gears. The machine used in this application is a 15-ton, 90" stroke model.

The hydraulic system of the machine is designed to offer a 40% safety overload margin above the machine capacity. This minimizes shock and reduces vibration, besides giving reserve power when needed. Hydraulic power is furnished by a rugged vane-type pump.

Constructed on a one-piece welded frame, the machine uses heavy side plates with rolled edges for extra strength and attractive appearance.

REDESIGNS SHOWER HEAD FOR PMI AWARD

Ernest J. Urbas, (right) director and superintendent of the tool, die and engineering department of the Guarantee Specialty Manufacturing Company, and Contributing Editor of TOOLING & PRODUCTION, was presented with the 1957 John Woodman Higgins Redesign Award last month for redesigning a shower bath head for stamping which formerly had been made by combining a threaded brass tubing with a brass screw machine part. J. W. Kootz, chairman of the Pressed Metal Institute's Technical and Standards Committee, made the presentation at the PMI Spring Technical Meeting last month. The $500 first prize is annually donated by the Worcester Pressed Steel Company.

SOCIETY IS FORMED TO SERVE PRODUCTION AND INVENTORY CONTROL MEN

First steps have been taken toward establishment of a national society to serve the highly specialized needs of those industrial executives who are directly responsible for production control and inventory control activities.

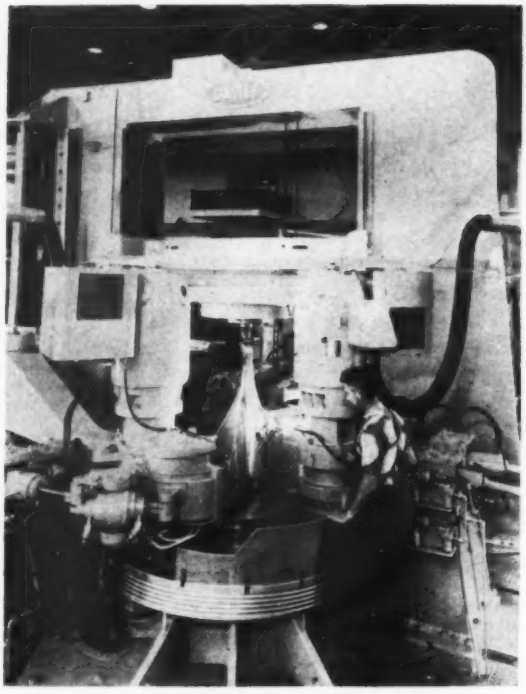
On March 9th, a sizable group of such executives gathered in Cleveland to pool their thinking as to the type of society that would best serve them. They adopted a name—the American Production and Inventory Control Society (APICS), outlined their principal objectives, elected officers pro tem, and named committee chairmen to serve during an interim period while a Constitution & By-Laws are drawn up and the society's permanent structure defined.

Executives operating in this field have come to regard it as a profession, since it is both art and science, and requires extensive and continuing education and experience. APICS aims to foster and to maintain high professional standards, to establish an exchange of mutual problems and ideas, to promote educational programs at local and regional and national levels, and in general to help its members keep abreast of the latest techniques and systems pertinent to their responsibilities.

The society will seek to facilitate attainment of these objectives by establishing as rapidly as possible a network of local chapters throughout the United States and Canada. Several already-existent local production control groups were officially represented at the Cleveland meeting for the express purpose of helping to found a national society.

Officers pro tem are president, M. W. Maddox, Mueller Brass Co., Port Huron, Mich.; vice president, R. E. Carruth, Acushnet Process Co., New Bedford, Mass.; secretary, Don Burkhart, Haynes Stellite Corp., Kokomo, Ind.; and treasurer, Louis Norheimer, Tube-Turns, Inc., Louisville, Ky. Each of these officers holds the title of production control manager in his plant. Temporary chairman of the first meeting was Nyles Reinfeld of National Institute of Management, Inc., Cleveland 14, who will serve as chairman of the membership committee.

. . . Giant Airflow from Page 92



Two milling cutters shown in action on an airfoil shape in this closeup view. To the rear of the workpiece is the wooden pattern.

workpiece are mounted vertically, in contrast to previous airfoil mills of horizontal design. This method eliminates any bending that might result from the weight of the metal blank being shaped.

Much of the giant machine is hidden from sight in a pit beneath floor level. The subfloor area is 25′ x 25′ x 15′ high and contains a smaller pit 8′ deep x 6′ in dia. The latter pit accommodates mechanism for the turntable on which the workpiece rides. The machine rises 17′ above the floor of the Ames Laboratory Machine Shop, and occupies an area of more than 600 sq. ft.

Seventeen electric motors are required to operate the airfoil machine. Two spindle motors of 75 hp each drive the metal-cutting tools which shape the blank. Others turn the table on which the pattern is mounted, provide lubrication, pressurize the machine's complex hydraulic system, and furnish cooling where necessary.

A wide range of flexibility has been built into the machine so that it can work various materials. For cutting alloy steels a speed range of 78 to 785 sfpm is available; for aluminum alloys, speeds between 314 and 3140 sfpm. It is capable of working to an accuracy of 0.004″ over a 24″ chordal length, and maintaining a good quality of finish.

end

DIVIDING SKILLED GROUPS INCREASES EFFICIENCY

The years of apprenticeship and journeyman experience gained by top-flight toolmakers are wasted when their efforts are directed to channels other than toolmaking. Dana Corporation's Parish Pressed Steel Division in Reading, Pa., realized this a few years ago and successfully corrected the situation by separating toolmakers and machinists.

Until that time, the division's toolmakers, machinists, and apprentices worked as a group in one plant area. The arrangement seemed entirely logical until toolroom supervisors began analyzing the situation which had evolved unconsciously.

Toolmakers were operating machines during a substantial part of the time, they found, rather than concentrating on tool layout and assembly. Machine operators, although not properly trained for it, were doing bench work. The skill-wasting situation was climaxed one day when Parish's general toolroom foreman noted that at one time five toolmakers were performing simple machine operations.

Immediately after this company officials decided the most effective way to eliminate such costly practices would be to separate completely the toolmaking and machining functions. Toolmakers were put in one department and machinists in another. Apprentices are assigned to both departments on a scheduled basis, under this arrangement.

The results, records indicate, are numerous and favorable. Every man is doing the specific job covered by his aptitude and wage scale. This is especially important, supervisors point out, because even the most skilled toolmaker is not always a proficient machine operator.

With the two functions divorced, Parish assigns each machinist to a specific machine. He gets to know his particular machine thoroughly and takes good care of it. Consequently, machine operating efficiency has improved and maintenance costs have decreased considerably. Higher quality work is coming off the machines, and equipment downtime is lower. Machine loading and scheduling has been facilitated greatly, including exact machine overtime requirements.

Although there was some complaining when the reorganization took place, the company reports, the toolmakers are now well-adjusted to and pleased with the change. Importantly, their prestige has increased substantially.

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MODEL 1F

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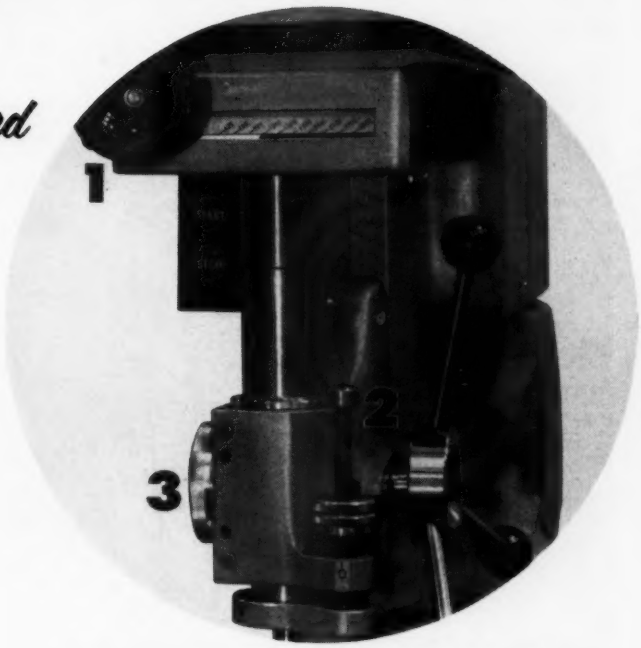
10,000 R.P.M.



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Model 1F—2 Spindle Pedestal Type

SPECIFICATIONS

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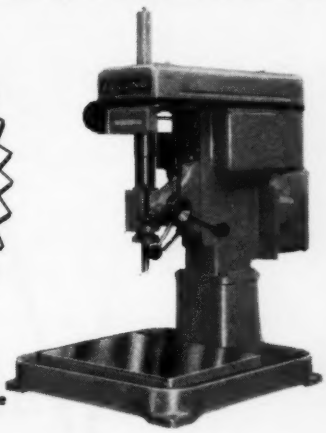
#1 Morse Taper or Jacobs Chuck	0-⅜"
Speed Range — Optional	625 to 5000 RPM 1250 to 10000 RPM
Spindles — 1 to 6	
Pedestal and Bench Types	

America's Most Popular Drilling Machine



Model 1F—1 Spindle Bench Type

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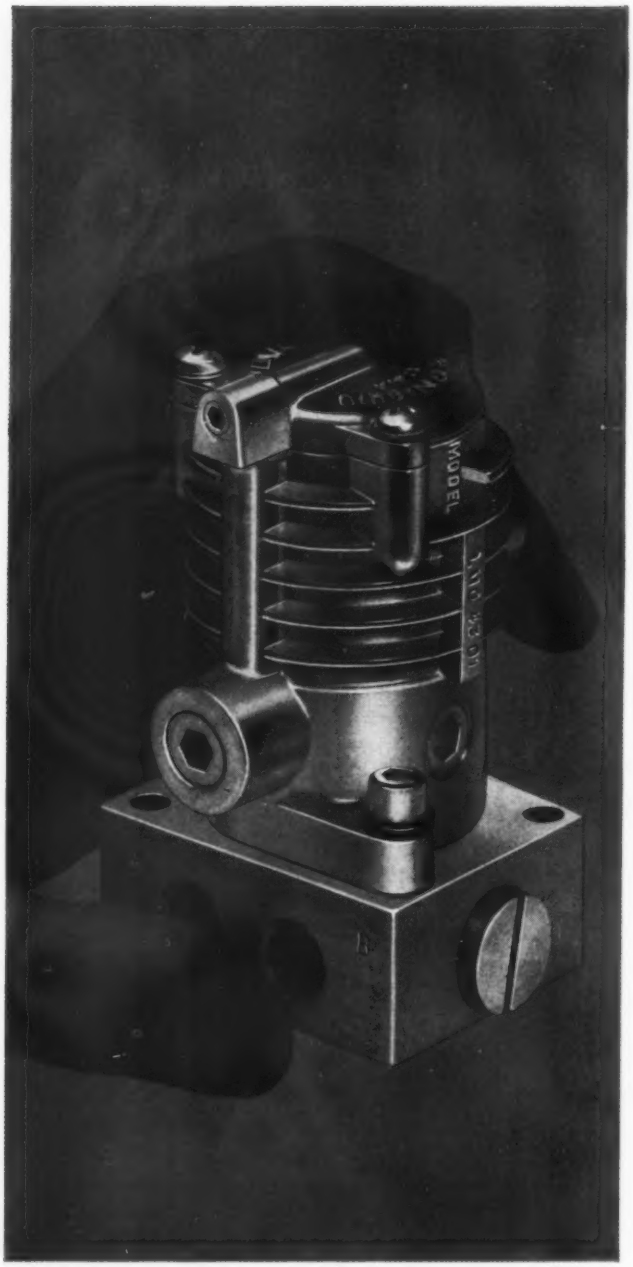

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CIRCLE INFORM-A-GRAM KEY NO. 116

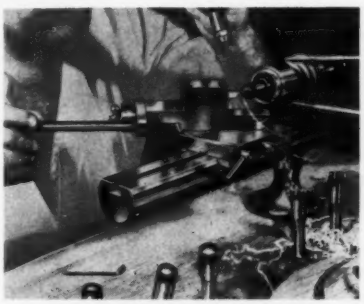
INSTRUMENT LATHES PRODUCE PRECISION CONTACT LENSES

The Tuohy Corneal Lens (U. S. Patent 2,510,438) being produced by the Solex Laboratories in Los Angeles, is recognized as a major advance in the field of contact lenses. It is thinner and much more comfortable than the older, larger type contact lenses.

Levin instrument lathes, a product of Louis Levin & Son, Inc., Los Angeles, fitted with the new Levin spherical turning rests, are used by the Solex Laboratories to produce these tiny, highly precisioned lenses, which when finished average 0.20 mm in thickness and weigh less than 1/50 of a gram.

The Levin spherical turning rest has vertical adjustment for centering the cutter and can generate either a convex or concave surface up to a 0.5" radius with accuracy to .01 mm.

A dime size disc stamped from a sheet of lucite is mounted in a step-collet and fitted into the Levin instrument lathe. The inside or concave surface of the lens is then cut

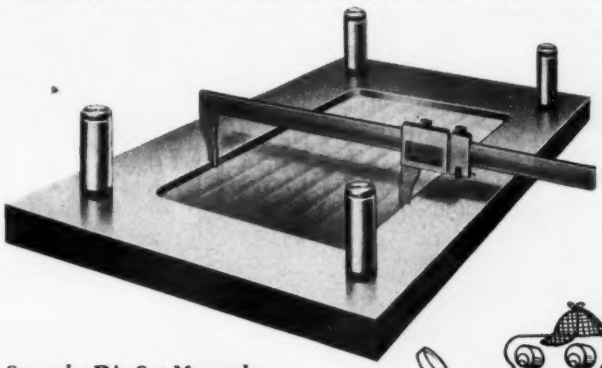


to fit the curvature of the patient's cornea.

Reversed and remounted on an arbor, the outside or convex surface of the lens is then cut to coincide with the required optical prescription. Finish produced on these cutting operations is fine enough so that lenses are polished after turning with no intermediate operations required.

The new Levin spherical turning rest can be applied to any model Levin instrument lathe.

A combined production of more than 28,000,000 lbs of reinforced plastics in 1956 was reported by six nations. The announcement was made at the International Session of the 12th Annual Exhibit and Conference of the Reinforced Plastics Division of the Society of the Plastics Industry. The six countries presenting the total 1956 poundage figures were Britain, France, Italy, Japan, Netherlands, and West Germany.



Stan the Die Set Man solves . . .

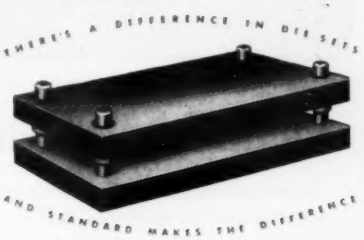
THE
CRAZY CASE
OF THE
DRIFTING DIMENSIONS

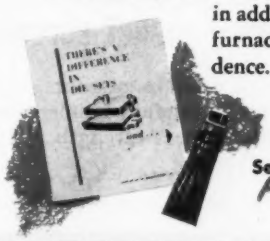
CASE HISTORY: Expert diemaker accurately mills pocket in which to mount blanking die. Next morning, finds die does not fit pocket. Rechecks pocket with vernier calipers and finds dimensions have mysteriously drifted! Finds, too, that posts bind in bushings when he tries to reassemble die set. Result: diemaker almost loses mind . . . loses time and money, too!

SOLUTION: Diemaker calls Standard Die Set Engineer. (Smart move!) Learns that instability of steel in ordinary die sets often results in drifting dimensions. Learns, too, that Standard gets around this problem by *stress relieving* all punch and die holders. Meaning they are slowly heated to 1550° F. . . . soaked at this temperature for 3 hours . . . then gradually cooled to room temperature. This removes residual stresses . . . assures that dimensions "stay put" . . . provides absolute parallelism of working surfaces.

BEST OF ALL, Standard Stress-Relieved Die Sets are yours at prices competitive with ordinary die sets. Worth looking into!

SO HELPFUL is this service to tool and diemakers, Standard has now installed large annealing furnaces in Philadelphia and Indianapolis, in addition to the furnace at Providence.





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SELECTION OF MOST EFFICIENT EXPERIMENTAL DESIGNS

by Charles A. Bicking

Manager, Quality Control Branch
Research & Development Division
THE CARBORUNDUM COMPANY
Niagara Falls, N. Y.

WITH THE EXCEPTION of the words "most efficient," the title is self-explanatory. In view of the tremendous growth of interest in statistical designs in recent years, some familiarity with the terminology in use has been assumed. However, to establish a common point of departure, it will be necessary to describe a concept of what is a "most efficient" design.

What Is Efficiency?

In a strictly statistical sense, a most efficient design is one in which the error variance is minimized. It is common, moreover, to compare the error variance using a design with the expected variance if some other design had been used.[1,2] For example, Cochran and Cox give a table of the Efficiency Factor for balanced incomplete block designs relative to randomized blocks.[3] Fisher[4] discusses methods of estimating efficiency.

In a much broader sense, efficiency has also been taken to mean the degree to which the information from an experiment has been maximized for a given amount of work. A claim likely to be heard for statistically designed experiments is more information for less work. Taken from either angle, this concept of efficiency embraces several factors in addition to the relative size of the error variance. The number of experimental runs may be minimized; the discriminatory power of the statistical tests used may be increased; information on interactions may be enhanced; or the range of the factors studied may be increased. A criterion might be the success achieved in randomizing or balancing the effects of uncontrolled or unforeseen variables. Taken in this broad sense, efficiency will include speed, economy, and administrative considerations.

Still another way of thinking about efficiency might be to relate it to the rate at which a design carries problems along to satisfactory solutions. This may be a hard thing to pin down, but in one pilot plant experiment the introduction of statistical planning resulted in adoption of a satisfactory process six months ahead of scheduled completion at a cost 10% under the amount budgeted. In another instance, a chemical treatment to reduce the biological oxygen demand of sewage had been under evaluation for two or three years without conclusive results. Statistical summarization and analysis of the data that had accumulated led to the conclusion that the treatment was not effective. This may not represent an infinite increase in efficiency over the previous course, but maybe it is as close as one might expect to get. Note that this was a negative conclusion that closed the door to further experimentation along the same lines. Perhaps as much time and money can be saved by preventing experimentation from continuing down blind alleys as by moving it along more rapidly in positive directions.

Thinking of efficiency in terms of time required to reach valid conclusions puts emphasis

on end results rather than on techniques by which the results are obtained. This kind of a philosophy is likely to strike a responsive chord in industry. It is probably not too bad an approach to take because of the many imponderables encountered in most experimental work. A successful stroke in choice of variables, in controlling the sampling, or refining the measurements may mean as much in the end as the improvement of efficiency of the design.

The Nature of Good Design

Design Simplicity. Refined statistical designs are by no means the only ones that pay off and it sometimes happens that designs of an older type, not at all sophisticated statistically, pay off handsomely. In other instances, the statistical planning required is rudimentary because of the simplicity of the experimental situation. Much of the testing necessary for evaluation of Ordnance material can be done in accordance with very simple designs. In guided missile testing, for example, the high cost of a single firing is a strong deterrent to anything but the simplest comparisons. What one has to do, many times, is to avoid the common tendency to try to get information on many variables. Instead, plan to get limited information on a few. The experiment will be very much simpler than it otherwise would have been. Statistical efficiency may still be low but the light that has been shed on the problem is concentrated.

Sequential Design. A design of high statistical efficiency standing alone may not be as desirable as a series of less ambitious designs which sequentially add to knowledge about the problem. An example of this is the practice of some successful experiment designers of using Latin Squares for scouting runs followed by full Factorial Designs for the most important variables. A good design is one which lends itself to extension even though it adds only a small increment to knowledge. The design of experiment implies an objective, systematic approach rather than a "flash of genius" approach to the solution of problems. It is a part of the modern shift in mode of outlook from the qualitative (Aristotelian) approach to science to the quantitative (Galilean) approach.[5] In a recent talk on "Brainstorming", a speaker advised that "anybody can solve scientific problems by brainstorming; in fact, that engineers do poorest since their approach is logical and non-creative." This sounds like reconverting science into an art.

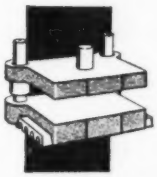
Brainstorming does not solve scientific problems, although it may amass alternative possibilities for solutions. But brainstorming does not sort good alternatives from the bad and does not evaluate the alternatives selected for investigation.

The General Electric Company, in its creative engineering course, stresses a four-step procedure of definition, search, evaluation, and solution.[6] This does seem to couple creative thinking about a problem with a systematic plan for its solution. It resembles closely what industrial statisticians have been saying for many years about the designing of experiments. A valid conclusion can result only when the problem is stated without reference to the results. We do not start with answers but with hypotheses which are then tested. Alternative outcomes should be considered before the experiment is done but other possible solutions, whether recognized in advance or arising out of the work done, must be made the basis of independent hypotheses which are then tested by further experimentation. This is a characteristic of efficiency in experimentation.

Peculiarities of Industrial Experimentation. There are several respects in which industrial experimentation is different from agricultural experimentation, from which modern statistical designs arose. The possible alternative outcomes in the industrial situation are extremely numerous. This requires a preliminary set of results, or a series of such sets, to serve as a guide for the succeeding phase of a program. The industrial experimenter traditionally operates in this manner.[7] This means that he is concerned with small numbers of repeat measurements, with experimental blocks of small size but which have enduring meanings, and with the impossibility of running many comparisons in parallel.

Experimenters have had habits of extreme flexibility but this flexibility has not always been well used. What is needed is the application of sound sequential procedures in designing industrial experiments. One does not find many advocates now of detailed scheduling of whole experimental programs. This may be because of the rapid development in recent years of new and powerful techniques for sequential experimentation.

It appears, then, that the statistician helping the engineer design a test program will have many considerations in mind in addition to statistical efficiency of design. It will be very important to him to make sure that a useful conclusion can be reached directly while working within technical, economic and human limitations which the engineer may be much



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Madison, N. J. Frontier 7-0707
Schenectady, N. Y. Franklin 2-4381
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CIRCLE INFORM-A-GRAM KEY NO. 121

better able to foresee than he is. The end result should be efficiency in the broadest sense.

A Horrible Example of Design

Perhaps a horrible example may be used to illustrate the kinds of difficulties both the engineer and the statistician may find themselves in when extremely limited in the extent of experimentation possible.

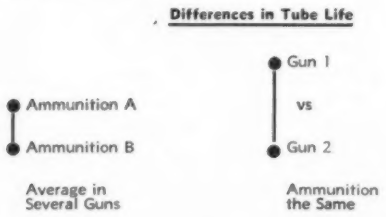
A test was desired to determine the wear characteristics and service life of a gun design, using each of two ammunition types. An adequate quantity of the two cartridges was available but, unfortunately, it was contemplated that only two gun tubes would be used. The test procedure called for using one type of ammunition in one tube and the other type in the other tube. This plan is diagrammed in Table I.

TABLE I

Gun 1	Gun 2
Ammunition A	**Ammunition B**
Round 1	Round 1
Round 2	Round 2
Round 3	Round 3
etc.	etc.

The program as outlined by the engineer was inadequate, of itself, to meet the stated objective of the test.

Experience has shown that even under carefully controlled conditions the difference in wear between several tubes of the same design may be very great. On the other hand, the velocities of the two cartridges to be tested were not much different and the actual differences in wear between cartridge types might be no more than the difference between tubes, and might be a great deal less. Data are readily available to show that there is more difference between two tubes using the same ammunition than between ammunition types even where the ammunition differences are much greater than in the present test. This is illustrated by the following sketch:



From the standpoint of the reliance that could be placed in the test results, the proposed plan of test is unsatisfactory. The differences between cartridge types is confounded with the difference between tubes. Only a very vague kind of conclusion can result from this test. For example, it may be possible to say "Using either shell type A or shell type B the average life of the gun is x rounds." This "x" value will have a very wide confidence limit which includes both variation between tubes and variation between cartridges. It will be completely unrealistic to make any statement concerning the average life of the gun using either cartridge separately.

The extent of test contemplated is inadequate to give a very reliable estimate of wear life even with the best possible design of test using only two tubes. However, since we are always faced with an economic limit on the amount of testing we can do, a preferred plan of test is suggested, involving two tubes, in both of which the same type of cartridge is used. This will provide a reasonably reliable answer to the question of average gun life using one type of cartridge. Perhaps it will be possible to infer from other data what the other type of cartridge would do.

Give and Take in Experiment Planning

It probably will always be a shocking thing to have an engineer reject a design which a statistician considers adequate in favor of a more extensive design. It happens occasionally, however, as in the instance when an engineer chose to run three replications instead of two, a third more work than the statistician thought was necessary. This was in a 13 x 2 Factorial Design in which 13 different materials were used in each of two grade formulations as shown in Table II.

TABLE II

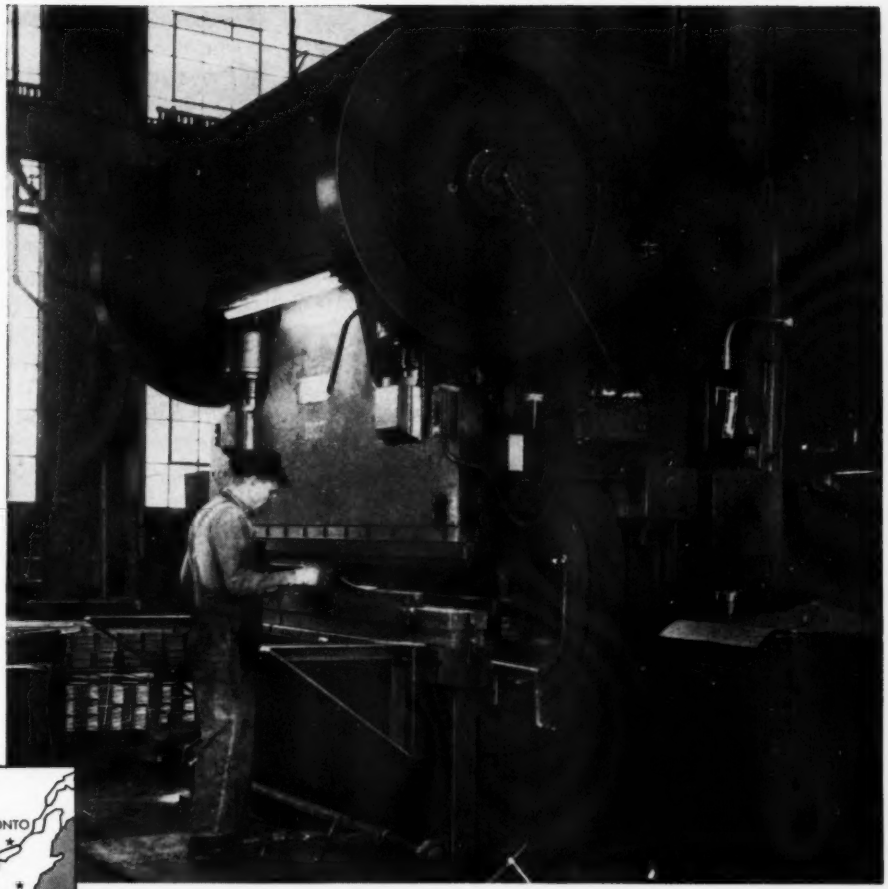
Three test pieces in each block

Material	1	2	etc.	etc.	13
Formulation A					
Formulation B					

The argument was that three test pieces should be made from each batch because of the large variability normally encountered between test pieces from the same batch.

The engineer usually has a reason and, to the extent that it is a valid reason, it must be listened to. A workable approach to selection of most efficient experimental designs, then, must be one that not only takes into account statistical efficiency and fulfills the practical desideratum of more information for less expenditure, but that also satisfies engineering requirements.

. . . *Continued on Page 124*



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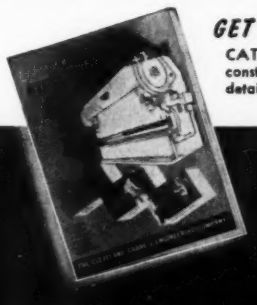

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The reason given in the example cited was not a particularly good reason. Assuming homogeneity, or the presence of no bias, in the way test pieces are made from a given mix, two per mix would give a measure of repeatability not inconsistent with other restrictions inherent in the design. The engineer had hoped to get some help in minimizing the experiment in other ways — a very difficult matter in a two factor, discreet model design even when the number of levels of one of the factors is large.

As is often the case, he had other more compelling reasons for maintaining the number of replications at three than the one he presented. It turned out that the capacity of the mixer was material enough for three test pieces. Experience had shown that mixing was optimized for approximately this amount of material and this was the standard number to be mixed at one time. He did not warm up at all, perhaps understandably, to under-loading the mixer by cutting the mix down a third in size.

Another angle in this design is that the replication considered thus far is not a true replication of the experiment, that is, of the mixes. What we have is replication within mixes and this is not an appropriate error term for testing the significance of differences between materials or grade formulations. Thus, if the mix-to-mix variation is large, the experimenter is in a fix and his method of replication has done little to help him. A design much to be preferred is one in which each mix is repeated once with only two test pieces made per mix. This, however, would have increased the time required and the cost objectionably.

If there is no interaction between materials and grades, that is, if the shift in grades affects all materials in the same way, the engineer may not come out too badly. (He gave assurances that interactions were not to be expected). However, if the interaction is large, his ability to detect the differences he is looking for is minimized. Replicating three times within mixes, or even two times, helps him not at all.

It is probable that the engineer's feeling of a need for as large as possible a number of test pieces was not based on a real understanding of the sources of variability in the experiment. He must know, to act intelligently, whether the apparent variability in results is really due to variation among the test pieces within a batch or to differences between batches. His experiment is not arranged to answer this for him and he can arrive at a complete answer to his problem only if he has such information from previous experience or has planned his work sequentially so that the missing pieces of information may be picked up later. The engineer, incidentally, carried out the work as he had planned it, with the understanding that information on batch differences would have to be determined by further experimentation.

Example of a Design Involving Many Factors

A firing program was required to determine the ballistic differences attributable solely to the counterbore of a howitzer tube using two types of shell. Consequently, a plan of test which would eliminate effects of all other variables was desired. Ballistics differences might occur due to ammunition, tubes, mounts, weather conditions, and so forth. The effects of tubes, mounts, and ammunition could be balanced between counterbored and not counterbored results. The effects of uncontrollable factors like weather could be diminished by randomization. Accordingly the following plan was adopted. The numbers in the body of Table III indicate the order of firing of the series in which a limited type of randomization was used. Series in counterbored and non-counterbored tubes were to be fired alternately.

It will be noted that the balance of the design permits comparisons of tubes, mounts, and ammunition, as well as the counterbore effect.

The Value of Grouping in Firing Tests

The technique of conducting firing in groups is extremely important because a comparison can be made of the variation within groups and the variation among groups. This is useful to observe how much of the variability is a result of day to day variation between groups, including effects of weather and other metro conditions, and how much is variability which is apparently due to unknown or uncontrollable causes.

It will be illustrated by the following example: Suppose a certain rocket program calls for firing at three nominal slant ranges and with three levels of propellant temperature. The dependent variable is the azimuth coordinate of miss distance and three groups of three rounds each will be fired for each set of conditions. (Data from the same group of three rounds are placed together in a vertical column of Table IV.)

It is possible to analyze this table to determine effect on miss distance of slant range, propellant temperature, any interaction between the two, the differences among the groups, and the remaining variation within the groups. Actually for these data, the differ-

ences among the groups (vertical sets of three) are not significant compared to within group variability. Thus, if the groups were fired in different days it could be said that different days introduced no new variable into the test, also, it appears that there is no inter-relationship between slant range and propellant temperature, and that both slant ranges and propellant temperatures have significant effects on miss distance.

The foregoing examples have illustrated some of the difficulties encountered in obtaining efficient designs. The difficulties may be of an engineering nature, may arise due to time or cost limitations, or may be inherent in the complexity of the experimental situation. Often there are strong incentives for getting along with the work even if designs that are far from being statistically most efficient must be used. However, much give and take must go on between statistical and engineering considerations; there is a limit beyond which the broader claims of efficiency do not allow one to go. There is no point in performing the experimental work at all if the effects of the factors under study will be completely masked. The whole point is that care in planning will improve efficiency even if the outcome is only a small increment of knowledge in a small segment of the larger area of interest.

Conclusion

An attempt has been made to show, more by argument than example, that the over-all efficiency of experimentation depends on far more than the availability of a good statistical design. Much depends on what might be called sound statistical engineering.

As usually carried out, statistical engineering implies close teamwork between statisticians and engineers. Indeed, teamwork is still necessary even when the statistical design know-how is provided by individuals with strong engineering backgrounds.

The background for selection of a design should be laid in a conference among all interested parties.[8] One of the skills which a budding experiment designer must acquire is that of leadership in bringing out the salient technical information without which selection of the statistical design has only theoretical basis. Too much time and too much effort can hardly be spent on this phase.

The design may actually be selected during this conference or the individual serving as an expert may propose a design to the group after thorough study of all the factors brought to light. Either way, care must be taken that all involved have a clear understanding of what is to be done and of what the capabilities of the design are.

An efficient design, in the sense that has been used here, is one that also satisfies a final requirement. This is the requirement that a design to be good must produce results capable of being verified independently. This is a mark of all good scientific work. end

TABLE III

Five Round Series for Each Set of Conditions

Ammunition (Same lot for each zone)	Mount	Counterbored Tube 1		Counterbored Tube 2		Not Counterbored Tube 3		Not Counterbored Tube 4	
		1	2	1	2	1	2	1	2
Type 1—Zone 1		1	14	17	10	14	1	10	17
Type 1—Zone 5		2	15	18	6	15	2	6	18
Type 1—Zone 7		3	11	19	7	11	3	7	19
Type 1—Zone 7 1000 yd Vertical Target		4	12	20	8	12	4	8	20
Type 2 1000 yd Vertical Target		5	13	16	9	13	5	9	16

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TABLE IV

Miss Distance (Coded)

Propellant Temperature	Slant Range	SR_1			SR_2			SR_3	
PT_1	—10	—22	— 9	— 5	—17	— 4	11	—10	1
	—13	0	7	— 9	6	13	— 5	10	20
	14	— 5	12	21	0	20	22	6	24
PT_2	—15	—25	—15	—14	— 3	14	— 9	8	14
	—17	— 5	2	15	— 1	5	— 3	— 2	18
	7	—11	5	—11	—20	—10	20	—15	— 2
PT_3	—21	—26	—15	—18	— 8	0	13	— 5	— 8
	—23	— 8	— 5	5	—26	—13	— 9	—18	3
	0	—10	0	—10	—10	3	—13	— 3	12

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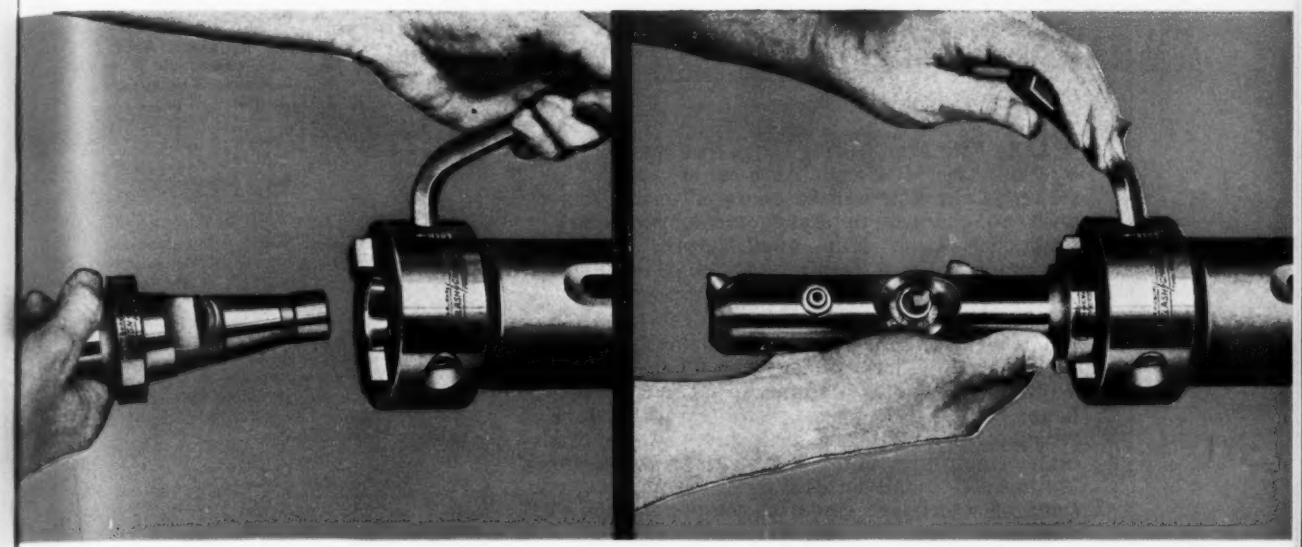

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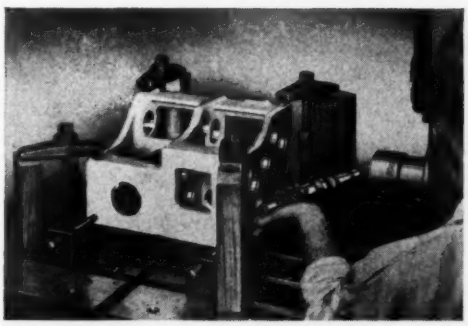

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● Simpson Electric Co. has announced the acquisition by its parent company, American Gage & Machine Co., of Standard Transformer Co. of Warren, Ohio.

● Lake Erie Engineering Corp. has been acquired by Bell Aircraft Corp. As a wholly-owned subsidiary, Lake Erie will be operated independently with no changes in management, personnel or products. Lake Erie manufactures hydraulic equipment such as forming, drawing, forging, die casting, extrusion, and molding presses.

● Parker Appliance Co. of Cleveland, has purchased two West Coast concerns, The Franklin C. Wolfe Co., Inc. and Mathewson Corp. Wolfe has developed several types of patented sealing devices which have filled a need for leakless sealing in aircraft, electronics and other critical applications. Mathewson manufactures precision metal parts, some of which are essential components of such sealing devices.

New Corporation Formed . . .

● Geartronics Corp. has been formed to coordinate the research and manufacturing facilities of Massachusetts Gear & Tool Co. and Gear Systems Inc. Through Geartronics Corp., facilities for the production of both precision and commercial gears, complete gear systems, and gear research and development will be available for both industrial and military applications.

Attention Civilian Inventors . . .

● New devices are needed by the U. S. Armed Forces. There are nine problems baffling the armed services now. Among these are a non-magnetic compass, explosive mine detector, method for converting light into electrical energy, and a snow track eraser. Other problems to be solved include a destructive ray or wave, universal track, radical method for unloading ships, vehicle blackout devices, and a new type of communication.

Ford Produces Millionth Engine . . .

● The Cleveland Engine Plant No. 2 of Ford Motor Co. has produced its millionth engine since the start of production there two years ago.

Need for Adequate Lighting . . .

● A careful study of a plant's lighting system is needed if a majority of its employees are in the middle-aged bracket. Research data from the Lamp Division of General Electric Co. shows that after 45 more light is needed for these workers to see as well as the younger ones.

Cone Automatic Machine Co., Inc. has formed a new division to handle engineering and sales for the Pilot automatic copying lathe. This division's headquarters will be in the company's New York office. Its activities will be supervised by J. A. Gerard, first vice president of Cone Automatic.

◆

A Metallurgical Product Development Group has been established by Vanadium-Alloys Steel Co. Located at the company's main offices in Latrobe, Pa., the new group will be responsible for the introduction and application of new tool steel products to industry. This work will involve the institution of in-plant test programs, and the tabulation and evaluation of results. The group will be managed by H. G. Johnstin.

◆

A new West Coast plant has been opened in Glendora, Calif., by Avildsen Tools & Machines, Inc. The plant will manufacture high speed precision twist drills, reamers and carbide tools for the aircraft and general metalworking industries.

◆

The formation of a new division of Westinghouse Electric Corp. has been announced. Known as the X-ray and Industrial Electronics Division, it represents a merger of the X-ray Division and the industrial electronics department. The division's head will be W. J. Delaney, Jr.

◆

Simplex Equipment Corp., formerly a subsidiary of General Precision Equipment Corp., has been made a subsidiary of General Precision Laboratory. General Precision Laboratory recently received an Air Force $17,000,000 contract for airborne Doppler navigation equipment. A large portion of Simplex's 160,000 sq ft of manufacturing space will be used to handle current and future orders for this equipment.

◆

Completion of a new research facility at The Barden Corp. in Danbury, Conn., has been disclosed. The new center will be devoted to the company's accelerating program of research and development directed toward higher levels of performance of mechanisms using precision ball bearings.

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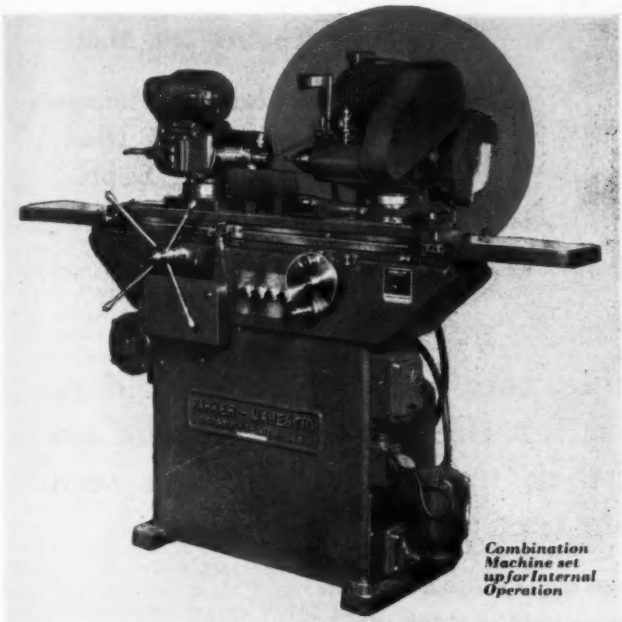

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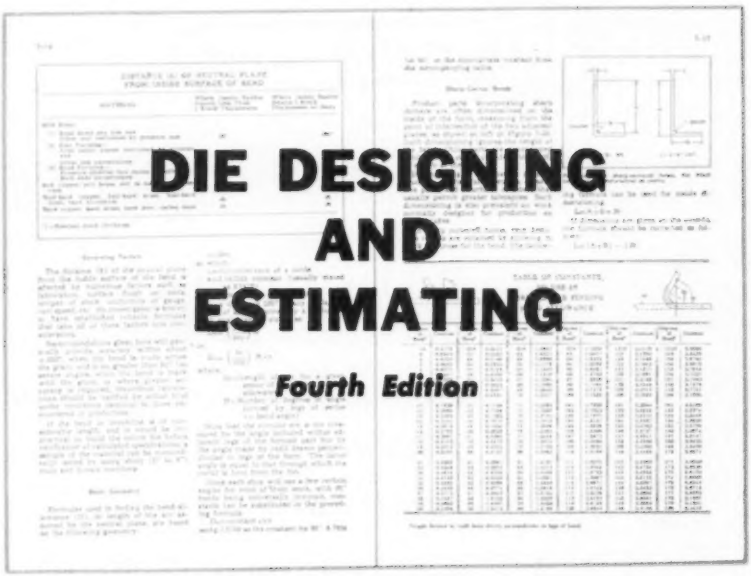

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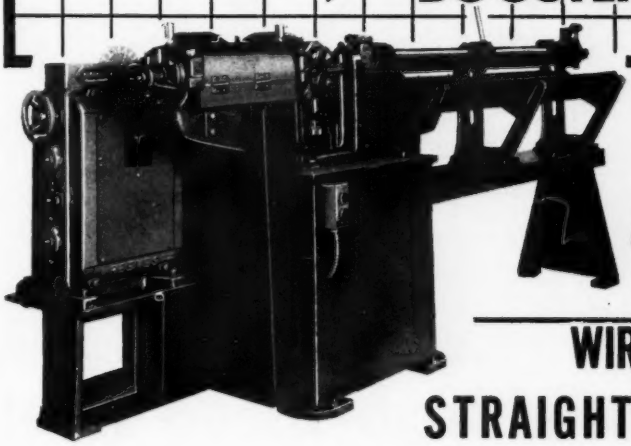

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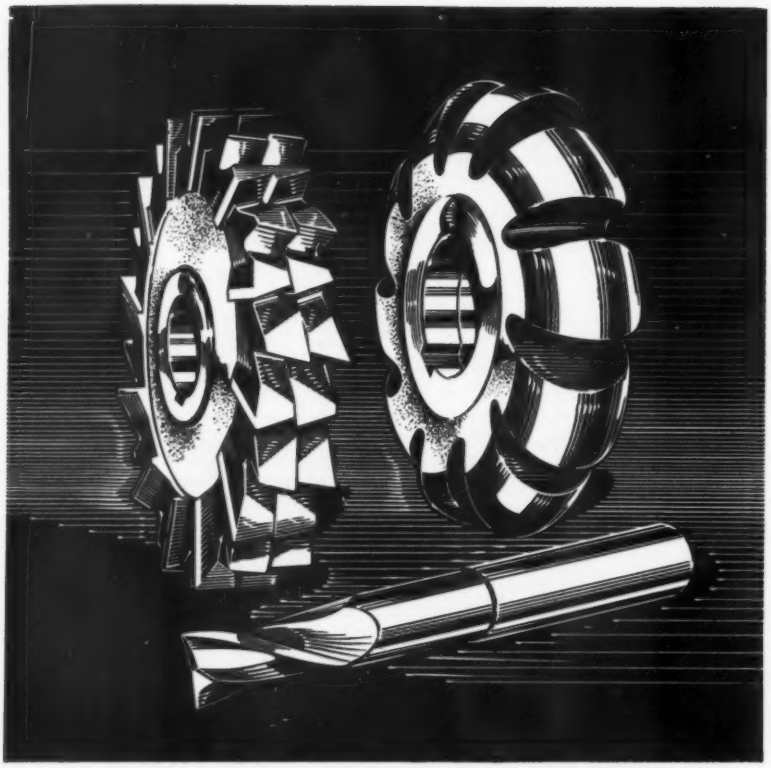
CIRCLE INFORM-A-GRAM KEY NO. 131



Are solid high-speed steel milling cutters obsolete?

If they are someone ought to tell our customers about it. They've asked us to produce so many styles and sizes that we finally went all the way and stock the most complete line available anywhere.

No, the solid high-speed steel cutters haven't been obsoleted by the carbides. When it comes to the smaller production runs and toolroom use, the solid steel cutters are *it*. Here, they'll perform more than adequately at the lowest possible initial tool cost. And they're much easier to maintain than the more costly carbide cutters.

Even though Go & Go produces a lot of inserted blade cutters, we're just as proud of our extensive line of solid high-speed steel cutters. Every tool is engineered with the same care and over 38 years of milling cutter know-how goes into each and every one.

Want to see the extensive stock of standards available? Ask for Catalog F, it's free on request. Go & Go also designs and manufactures special milling cutters in quantity. Check one of our engineering sales representatives in principal industrial centers for details.

Go & Go

GODDARD & GODDARD COMPANY
DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

CIRCLE INFORM-A-GRAM KEY NO. 132

10 Widely Held Misconceptions About Cylinders

In spite of its modern-day role in automated and semi-automated production lines, the fluid power cylinder is still the object of a number of misconceptions which hark back to its unhappy childhood.

Prior to World War II, many production and maintenance engineers hestitated to use the cylinder in many applications, primarily because of its early nemesis — leakage.

Precision machining and adherence to close tolerances in manufacture have resulted in leakproof cylinders and increased efficiency from 70% to 98% plus.

Manufacturers in the field have increased from a handful in 1946 to more than 160 in 1956, and the fluid power industry has become a $1.5 billion-a-year business.

Cylinders are used in hundreds of industries in thousands of applications — metal working and machine tools, food packaging, steel rolling mills, textile printing equipment, materials handling — right through to the fully automated lines which turn out motor blocks in auto plants.

Despite the cylinder's coming of age, many maintenance men and production engineers still think of compressed air and hydraulic cylinders as they were 10 years ago.

To find out the "10 most widely held misconceptions," Miller Fluid Power Division of Flick-Reedy Corporation polled hundreds of engineers. See how many of the old canards you recognize:

1. **Fiction:** It is impossible to make a cylinder that is leakproof.
Fact: "It's not so," Frank Flick, president of Flick-Reedy points out. "The industry has been making them for 10 years.

2. **Fiction:** Maintenance men can design and produce their own cylinders better than can a cylinder manufacturer.
Fact: It may appear so at first, according to Flick, but the end users cannot spend the time necessary to develop the "perfect" cylinder for their own applications. Nor do they have the experience in their manufacture.

A third reason why it's better to buy instead of make is that savings which appear to result are only on paper in many instances. Many companies simply add up the direct costs of labor and materials involved; they fail to include overhead which makes the paper saving disappear.

3. **Fiction:** All cylinders are alike.
Fact: There are as many kinds of cylinders as there are applications for them, Flick points out. They differ in performance, wear, durability, and efficiency.

4. **Fiction:** Air is cheap.

Fact: While maintenance men are very conscious of a leaky hydraulic cylinder, they tend to shrug off the leaky air cylinders because "air doesn't cost anything."

Very frequently, Flick says, air leakage is as great as that which would pass through a ⅛" dia hole. If plant air pressure is 80 psi, and the cost per 1,000 cu ft were 6c, air loss in a month would be $36.55, Flick estimates. Thus, savings in air leakage would pay for a leakproof cylinder in a very short time.

5. **Fiction:** Engineers should specify cylinder capacity ratings which are greater than the job requires, because an over-large cylinder is safer and sure to do the job.

Fact: Today's cylinders are built to operate at rated capacity with complete safety, and designed to deliver rated capacity. There is no point in paying a first-cost premium for a cylinder larger than needed. Flick adds that overrating can disguise any inefficient cylinder.

6. **Fiction:** Cylinders must be big and bulky because of the heavy housings necessary to make them safe and rugged.

Fact: Present day cylinders are constructed of steel for heads, caps, tie-rods, and tubing. The new stronger, more elastic steel means that cylinders don't have to be built with heavy, bulky cast iron housings.

7. **Fiction:** Cylinders are built to low precision standards.

Fact: Miller cylinder bores, for example, are precision honed to 15 micro-inches within .001" tolerance.

8. **Fiction:** There is nothing new in cylinders.

Fact: Reduced friction, nonleakage, and great safety are three recent advances in cylinder design resulting from constant engineering improvements. In addition, new cylinder applications are discovered every day.

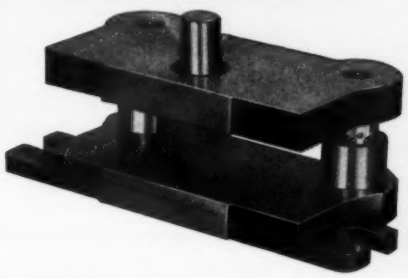
9. **Fiction:** Cylinders generally have low thrust and are inefficient.

Fact: Many engineers are surprised that a 2" bore hydraulic cylinder, fitting into a 3" square opening at 3,000 psi, produces nearly 5 tons of thrust. Cylinders with up to 200 tons of thrust are readily available and fit into a space 15" square.

10. **Fiction:** Proper alignment in attaching a cylinder to a machine is unimportant.

Fact: According to Flick, this alignment is the most essential single adjustment to proper operation and long cylinder life.

WHY DO YOUR COMPETITORS USE LEMPCO BALL-BEARING DIE SETS?



BETTER TAKE A LOOK AT SOME *GOOD REASONS!*

IN THE DIE SHOP!

Easier assembly and disassembly —no pry bars, hammers or winches necessary to separate punches and die holders. Save MORE than 10% on die *construction* with Lempco Die Sets . . . proved again and again by the country's biggest users.

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Now Lempco's line of Precision Ball-Bearing Die Sets includes new low-priced all-steel sets, Style "M", and "L", at the price level of friction-type cast-iron die Sets.

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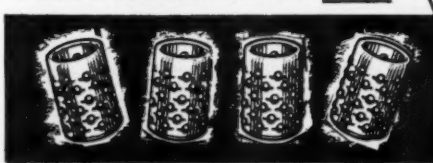

LEMPCO INDUSTRIAL, INC.
DUNHAM RD., BEDFORD, OHIO

WHERE QUALITY CONTROLS

CIRCLE INFORM-A-GRAM KEY NO. 133

The Sperry Hydraulic Control, a self-contained system, consists essentially of a hand-actuated transmitter and a receiver connected by a single tube. There is absolutely no dependency on outside sources of power such as electricity or air which are subject to failures. The system is filled with hydraulic oil, and due to the oil's incompressibility, force applied to the transmitter is immediately delivered to the receiver. Any movement of transmitter handle is duplicated by the receiver lever. The Sperry Hydraulic Remote Control System makes possible precision operation of a remote mechanism, free of backlash and the "sponginess" of the ordinary pneumatic control. The operator is assured of instantaneous response, extreme accuracy and "feel" of the operated mechanism even though it is often out of sight and many feet away. Simple and inexpensive installation completes the features appreciated by all in industry.

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Brakes	Hydraulic Pumps	Grinder Spindles
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Throttles	Engine Spark Adjustments	and many others
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Valves	Variable Speed Transmissions	
Rheostats	Hydraulic Transmissions	
Trippers	Fire Extinguishers	
Releases	Feed Mechanisms	

Bulletin 20-106 gives complete information on Sperry Hydraulic Remote Controls. Write for your copy today.

404 Shelter Rock Road Danbury, Connecticut

sperry products INC.
INSPECTION and CONTROL

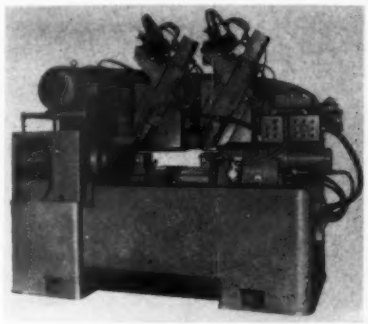
DOUBLE TRACER LATHE ROUGH AND FINISH TURNS

Axle shafts, motor shafts, cam shafts, etc.—all of which are normally turned with multiple tooling and require separate machines for rough and finish operations — can now be handled in a single setup on double tracer lathes.

These lathes are products of the Hydra-Feed Machine Tool Corporation, who pioneered the distinctive top arrangement of mounting the two tracers in a variety of combinations for the greatest possible efficiency on any particular installation. Several basic tracer combinations are possible:

1. Either right or left hand mounting of tracers or combination of both.
2. Tracers mounted in tandem with a single hydraulic feed cylinder.
3. Individual feed cylinders supplied for each tracer.

Greater accuracy and time savings are natural results of using the Hydra-Feed double tracer lathes since



the workpiece does not have to be handled and rechucked twice for separate roughing and finishing operations. The machining cycles are completely automatic and can be preselected for the particular operation involved.

Two different machining sequences are possible: (a) Traversing rear carriage operates first to perform multiple tool roughing operations after which the top carriage tracer slides move in for template controlled tracer turning or; (b) Top carriage mounted perform their turning after which the rear slides are used for form tool grooving and undercutting operations. Thus the operating cycle can be ideally suited to the nature of the part being machined to produce the highest quality work at the lowest possible cost.

Mounting of the tracer controls and template on the top carriage provides an ideal arrangement for maximum machining efficiency. Dust and chips will not gather on the vertical slide ways causing excessive wear and impairing accuracy of finished work.

. . . Continued on Opposite Page

CIRCLE INFORM-A-GRAM KEY NO. 134

. . . From Opposite Page

In addition, the operator has a clear view of the tracer stylus, cutting tool and workpiece at all times. All adjustments for setup and tool wear are within easy reach of the operator in his normal work position.

Faster loading and unloading with a significant lowering in operator fatigue are natural advantages resulting from the open, unobstructed, front design of Hydra-Feed lathes.

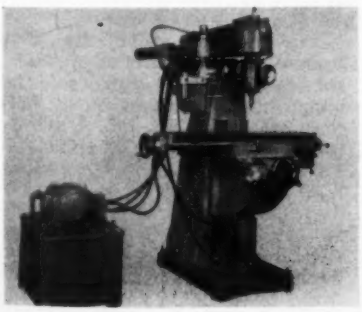
VERTICAL MILL IS NOW EQUIPPED WITH TRACER ATTACHMENT

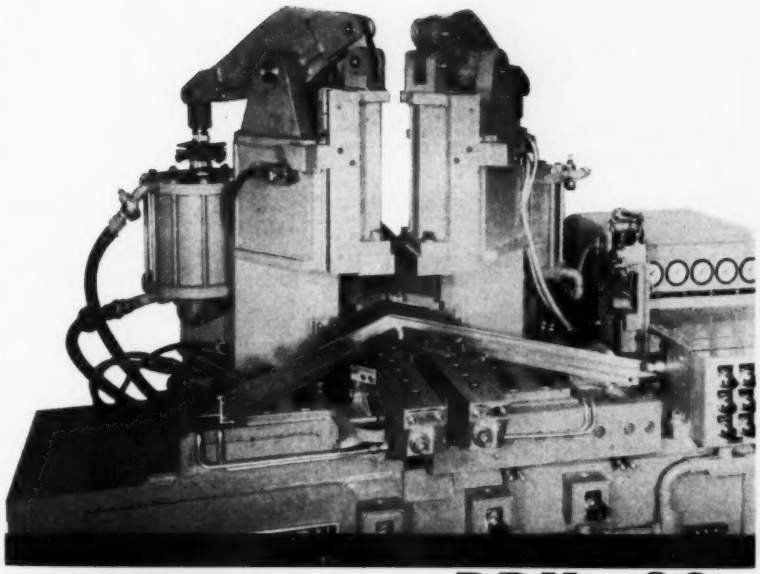
After a period of extensive experimentation, the U. S. Burke Machine Tool Division selected, as a tracer attachment for automatic control of their vertical milling machine, the Turchan Follower jack screw type, knee hydraulic system.

This system controls the vertical rise and fall of the table. It is actuated by a hydraulic cylinder mounted in place of the vertical mill's present vertical screw. Cylinder movement is governed by a tracer valve, working from a model or template located on the machine table. The stylus which governs the vertical movement of the table is set in the same plane as the milling machine spindle.

Range and capacity of the mill are in no way limited by the automatic control. Under normal machining conditions, the depth of cut can be controlled to within a tolerance of ±0.001". The machine table may be manually fed or its longitudinal movement mechanically controlled by the use of the standard variable speed table feed accessory.

Use of the U. S. vertical mill with tracer attachment will greatly simplify the machining of multiple molds and dies or production runs of complex parts. It will facilitate at a very nominal cost the production of parts that are now extremely difficult to machine with manual control.





Darwin

PRK • 33 TOOL STEEL

(Cobalt, High Carbon, High Chrome)

*Holds its edge at 1000° F.!

Above is the Thomson Synchro-Matic Welder performing a miter weld on an aluminum window extrusion. "Pinch-off" dies of PRK-33, a Thomson development, support the work close to the point of weld. After welding, this PRK-33 die moves in to pinch off the flash close to the surface of the work. Eliminates most cleaning and finishing of the weld.

After testing many die steels, Thomson now specifies PRK-33. They have found PRK-33 to be the finest high carbon, high chrome, with cobalt, die steel available. Its production record, its ability to hold a hard edge at high temperatures far surpassed all other die steels tested. Heat treated and double drawn at 980°F. gives PRK-33 a secondary hardness of 59-61 Rc.

Want these qualities in the dies you buy?—Write for full information NOW!

Complete Line of highest grade Tool Steels, including PRK-33, DARWIN No. 1, NEOR, MINEOR, OHT, "MT6" and various grades of Hot Work Specialty Steels. Furnished in Bar Stock, Forgings, and Sand Castings, Drill Rod, Flat Ground Stock and Tool Bits.

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highest grade tool steels

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CIRCLE INFORM-A-GRAM KEY NO. 135

TECHNICAL BOOKS

HUEBNER PUBLICATIONS, INC.
1975 LEE ROAD, CLEVELAND 18, OHIO

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Fourth edition. 368 pages, 26 chapters, and over 400 illustrations, drawings, charts and graphs. Extensively revised and enlarged plus a special section of 165 Practical Points in Die Design and Construction. Completely indexed.
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FILMS TO SEE

"Cold Welding," a 16 mm sound movie, gives an account of maintenance welding operations at Thule Air Base, Greenland. Available on a free-loan basis from Technical Information Service, Eutectic Welding Alloys Corp., 40-40 - 172nd St., Flushing 58, N. Y., this film shows welding operations that take place 900 miles from the North Pole. Shown are the special welding techniques and procedures necessary to overcome the maintenance problems faced.

The consumable insert welding process is described in a film which is loaned by Arcos Corp., 1500 S. 50th St., Philadelphia 43. "Consumable Insert Welding" shows the use of a special weld insert to join pipe by welding on one side only. Close-ups point out how the process produces root pass welds with particularly smooth uniform contours on the inside of the pipe which will minimize turbulence. Other parts of the film deal with the production of crevice-free corrosion resistant welds.

"William Johnson and the Draggin' " is a cartoon motion picture that points up the need for replacement of obsolete machines. It presents a modern concept of the topic of modernizing America's metalworking industries at a profit. The 16 mm film is loaned free of charge by Cincinnati Milling and Grinding Machines, Inc., Cincinnati 9, O.

The latest machine bending techniques are covered in a 40-minute color-sound movie. The 16 mm film shows both standard and special tooling applications in 36 different locations ranging from job shops to large multi-plant organizations. Pointed out are a number of unusual opportunities for cost reduction which cold machine bending offers metal fabricating plants. Included in the film are examples of both small lot and high production applications. The film is made available without charge by Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill.

The design and operation of the hydraulic Kopy-Kat Duplicator is shown in a 16 mm sound color film which has been produced by Rockford Machine Tool Co., Dept. AA, 2500 Kishwaukee St., Rockford, Ill. The movie, "The Rockford Kopy-Kat," includes animated schematic diagrams illustrating the operation of the valve and hydraulic system. Also covered are a variety of actual duplicating jobs from the simplest to the most complex types of work.

Photo courtesy of the R. K. LeBlond Machine Tool Company

THE LATHE — *LeBlond 25" Heavy Duty Engine Lathe*

THE OPERATION — *Rough sizing a steel 25" heavy duty spindle forging, using a 1/2" cut*

THE CHUCK — *Horton, of course*

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HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

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HAMMER FORGED *plus* POLISHED FLUTES

This hammer forged drill (a GTD-AMPCO specialty) even without polished flutes would still be a superior drill! Polishing the flutes, which means improved chip slippage, reduced friction heat and a tendency to reduce power consumption, give it still *another* plus value. All this at no extra cost to you!

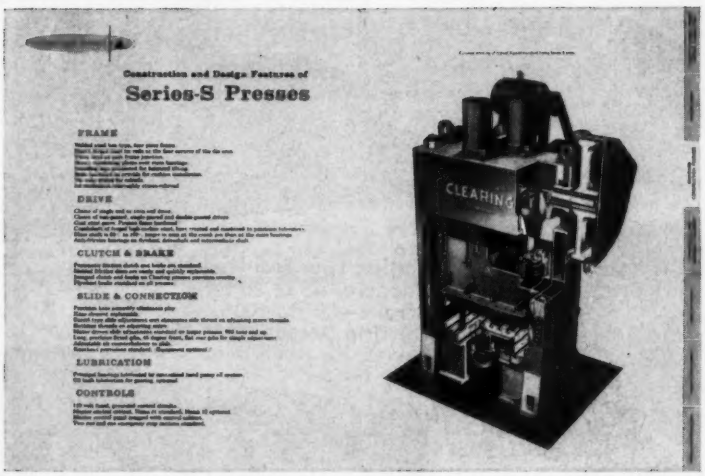
AMPCO TWIST DRILL DIVISION

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.

what you should know about

CLEARING S-TYPE PRESSES


Construction and Design Features of
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CLUTCH & BRAKE
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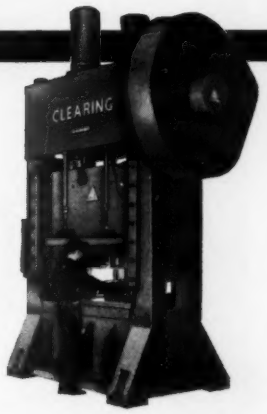
LUBRICATION
CONTROLS
CLEARING

it's all in this **new** CLEARING CATALOG



Here are all the vital statistics of Clearing's line of crankshaft Series-S presses. These presses give you the capacity and rigid construction for all types of drawing and heavy blanking operations, the precision that's required for progressive die work and lamination production. All the facts on these moderate priced, versatile machines are given in a colorful new 48 page catalog—complete specifications and full, accurate descriptions of construction and features.

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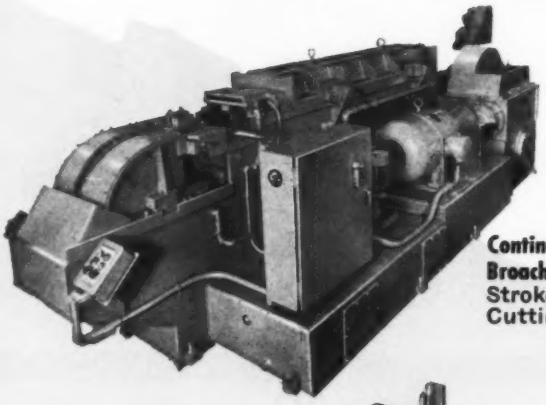
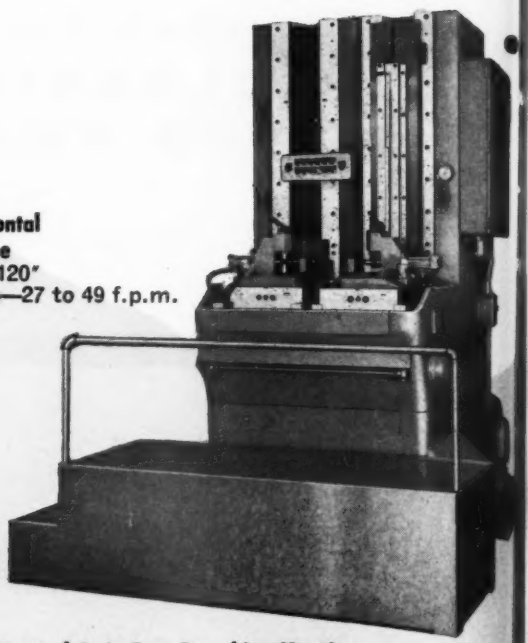
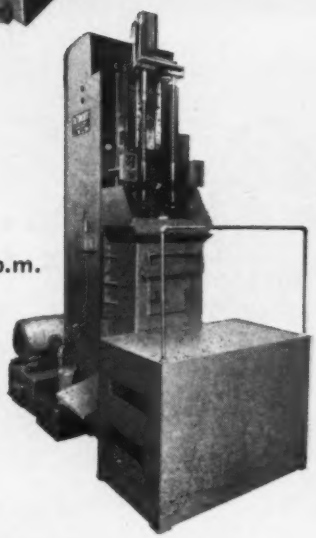
and Tomorrow's
for Today's Production



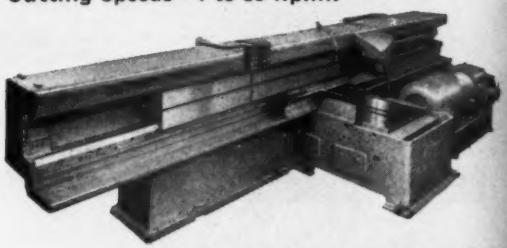
Continuous Horizontal Broaching Machine
Stroke—42″ to 120″
Cutting Speeds—27 to 49 f.p.m.



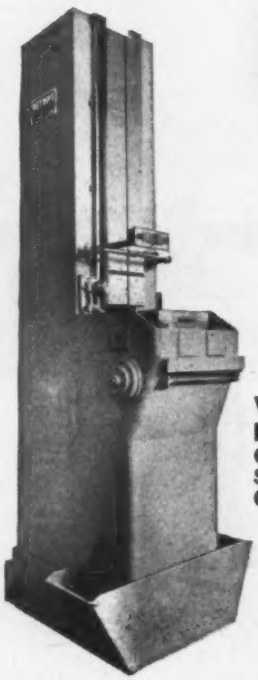
Vertical Pull-Down Broaching Machine
Capacity—5 to 50 tons
Stroke—30″ to 72″
Cutting Speeds—4 to 35 f.p.m.



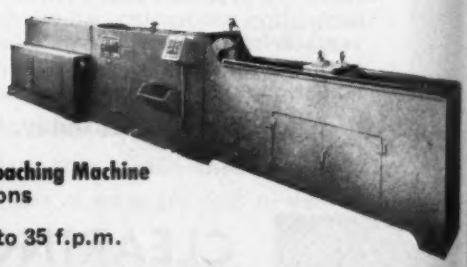
Vertical Twin Ram Broaching Machine
Capacity—5 to 25 tons
Stroke—30″ to 100″
Cutting Speeds—4 to 35 f.p.m.



Horizontal Surface Broaching Machine
Capacity—10 to 50 tons
Stroke—90″ to 240″
Cutting Speeds—15 to 300 f.p.m.



Vertical Single Ram Broaching Machine
Capacity—5 to 25 tons
Stroke—30″ to 90″
Cutting Speeds—4 to 35 f.p.m.



Horizontal Internal Broaching Machine
Capacity—3 to 50 tons
Stroke—6″ to 90″
Cutting Speeds—4 to 35 f.p.m.

NOTE—All capacities, strokes and cutting speeds given are for standard machines and will be varied to suit your requirements.

on Requirements

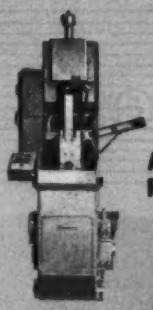
. DETROIT Broaching Machines

You want machines for *today's* production to be rugged . . . built to deliver high output consistently, without costly shutdowns. *But look to the future as well!* Be sure that these machines are also designed with maximum versatility . . . so they'll be readily adaptable to model changes for *tomorrow's* production, too.

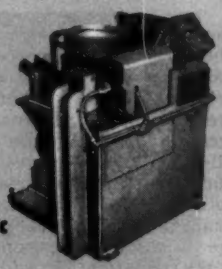
Detroit machines meet these requirements because they are:

- **RUGGED . . . take overloads 50% over rated capacity.**
- **FLEXIBLE . . . easily retooled for part or model changes.**
- **DEPENDABLE . . . rigid construction and stabilized hydraulic circuits assure consistent high production.**
- **SIMPLE . . . easy to operate, easy to maintain.**
- **VERSATILE . . . available with manual, semi-automatic or full automatic control plus automatic tool handling.**
- **PRECISE . . . total ram runout less than .0005" through strokes as long as 100".**
- **FOOLPROOF . . . full interlocking protects machine and tooling. All electrical and hydraulic equipment to J.I.C. standards.**

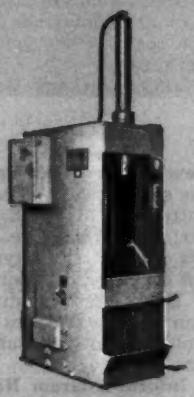
To make the best investment for today *and* tomorrow, consult our Engineering Department. They'll recommend the right high-capacity, high-performance Detroit machine to solve your problem, along with complete tooling and automation if required. Send parts, prints or details of your problem now.



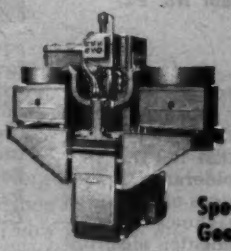
Automatic Side Plate Press



Special Automatic Assembly Press



Side Plate Press



Special Automatic Gooseneck Press

(Ask us to quote on any of your hydraulic press applications.)

DETROIT BROACH

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Please send me free literature on:

- ☐ Continuous Horizontal Broaching Machine
- ☐ Horizontal Surface Broaching Type
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- ☐ Twin Ram Vertical Type
- ☐ Pull-Down Vertical Type
- ☐ Broaching Tooling
- ☐ Presses

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

CIRCLE INFORM-A-GRAM KEY NO. 141

Business Management Aids

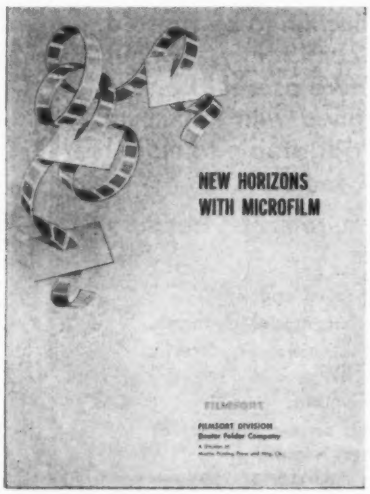
The LGP-30 Electronic Computer is the subject of a brochure from Royal Typewriter Co., 2 Park Ave., New York 16. It is a serial, single address, fixed point, binary, stored program digital computer. This small-sized, reliable, low-priced scientific computing device features simplified programming and a memory capacity of 4096 words. The brochure lists its applications and details the operation. In addition, general specifications are listed and an explanation of commands given. Contact the company for your copy of the brochure, or —
Circle Inform-A-Gram No. F1.

A New Divider Wall Partition for creating semi-private office units has been introduced by The E. F. Hauserman Co., 6800 Grand Ave., Cleveland 5. It is offered in two types with a total of 24 possible color combinations. Details on the divider wall partition and its features are found in a folder made available by the company, or —
Circle Inform-A-Gram No. F2.

Electrical Engineering Research Facilities at Armour Research Foundation are described in new literature. The information is presented in five four-page folders. Covered are research in the areas of computer systems; electric machines, components and measurements; electronic instrumentation; communications and radio frequency applications; and controls systems. For copies of any or all the folders, write to Electrical Engineering Research Dept., Armour Research Foundation, 10 W. 35th St., Chicago 16, or —
Circle Inform-A-Gram No. F3.

Simplify and Speed Up Record Handling with Index-Less tub files. A new completely mobile series of tub files will file from 3,000 to 24,000 tabulating cards or any size standard cards with a minimum amount of floor space. Special patented trays eliminate the use of index, with no need for offset trays, allowing faster card selection. For literature on the tub files, contact Ferris Business Equipment, Inc., 45 Seymour St., Stratford, Conn., or —
Circle Inform-A-Gram No. F4.

The Widening Scope of Microfilm as an everyday work tool for active paperwork is dealt with in "New Horizons with Microfilm." The booklet describes the growth of the Filmsort system for activating microfilm by mounting it in aperture cards or jackets. Given are details of new



equipment, supplies and techniques for handling various kinds of paperwork. In addition, case history reports on applications and savings are presented. Copies of the 36-page brochure are provided by Dexter Folder Co., Filmsort Div'n, 50 S. Pearl St., Pearl River, N. Y., or —
Circle Inform-A-Gram No. F5.

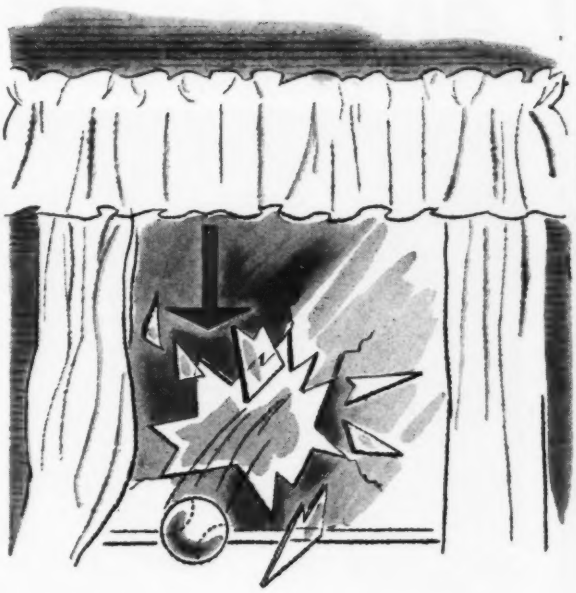
An Engineering and Planning Brochure can be obtained from Giffels & Valle, Inc., 1000 Marquette Bldg., Detroit 26. The firm provides a complete engineering service for the analysis of production requirements, development of process, layout and final design of facility, and supervision of installation. In addition, a Plant Layout Department is maintained to analyze and establish all phases of process, materials flow and layout of modern plants, and establish machinery and equipment requirements. Also, the firm has services for the development and design of special machinery, special conveyors and other materials handling devices, and the electrical and mechanical controls needed for all phases of automation. Obtain copies of the brochure from the company, or — **Circle Inform-A-Gram No. F6.**

An Intercom System has been designed to operate on any one of six channels without interference with other communication within the system. Selective wireless staff stations and selective paging with reply are features of new Model LCM-8806. This system is adaptable for additional units, starting with two. It is particularly desirable for instant or temporary installation since the unit plugs into a conventional electric outlet. For complete information, contact Talk-A-Phone Co., 1512 S. Pulaski, Chicago 23, or —
Circle Inform-A-Gram No. F7.

"What Edgewater Offers Industry." This 12-page brochure discusses both the advantages and the problems of the community of Edgewater, N. J. Detailed are the location and labor supply; industrial transportation facilities; industrial power, water and wastes; taxes; local government; and the community itself. Data sheets at the end of the brochure describe the industrial properties that are available at the present time. For your copy of the brochure, contact the Industrial Committee, Edgewater, N. J., or —
Circle Inform-A-Gram No. F8.

"How to Cut Coffee-Break Time in Half" is a catalog illustrating and describing both Kelvinator and Oasis Hot N' Cold water coolers, produced by The Ebco Mfg. Co., 265 N. Hamilton Rd., Columbus 13. The catalog tells how these units can be used to control the coffee-break problem and save money for the company. Also included are actual case histories. Copies of the catalog, Form 810, are issued by the company, or —
Circle Inform-A-Gram No. F9.

"The Inside Story of Outside Help" details the wide range of business consulting services provided by Ebasco Services, Inc., 2 Rector St., New York 6. The kinds of services available and the projects for which they are available are detailed, each in a separate section. In addition, a few of the typical Ebasco projects are shown. An insert included in the brochure is devoted to the company's departments. For further details, get a copy of the brochure from the company, or —
Circle Inform-A-Gram No. F10.



a hole here means work...

a hole here saves work

Crucible Hollow Tool Steel Bars take much of the work out of making ring-shaped steel parts, or tools with a center hole. The hole's already there. You save expensive drilling, boring, cutting-off and rough-facing operations . . . you reduce machine time and scrap losses.

You can now get Crucible Hollow Tool Steel Bars in any of the famous Crucible tool steel grades, in virtually any I.D. and O.D. combination. And you can get *immediate delivery* from stock of the five most useful grades — KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot-work tool steels.

Your Crucible representative can quickly show you how Crucible Hollow Tool Steel Bars will save you work and money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

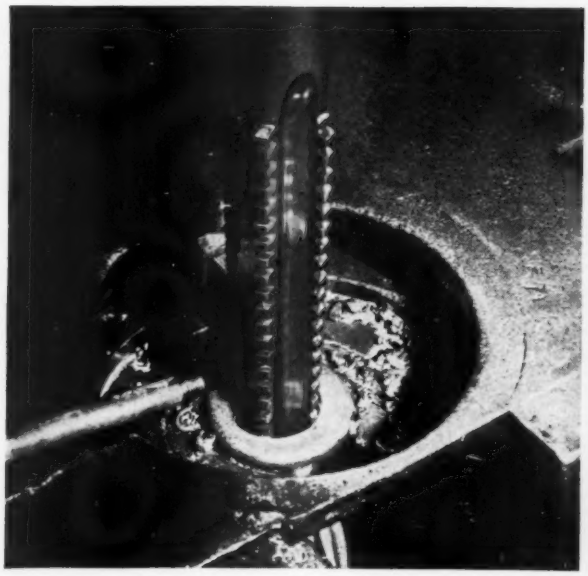
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

CIRCLE INFORM-A-GRAM KEY NO. 143

Cutting Tool and Gaging

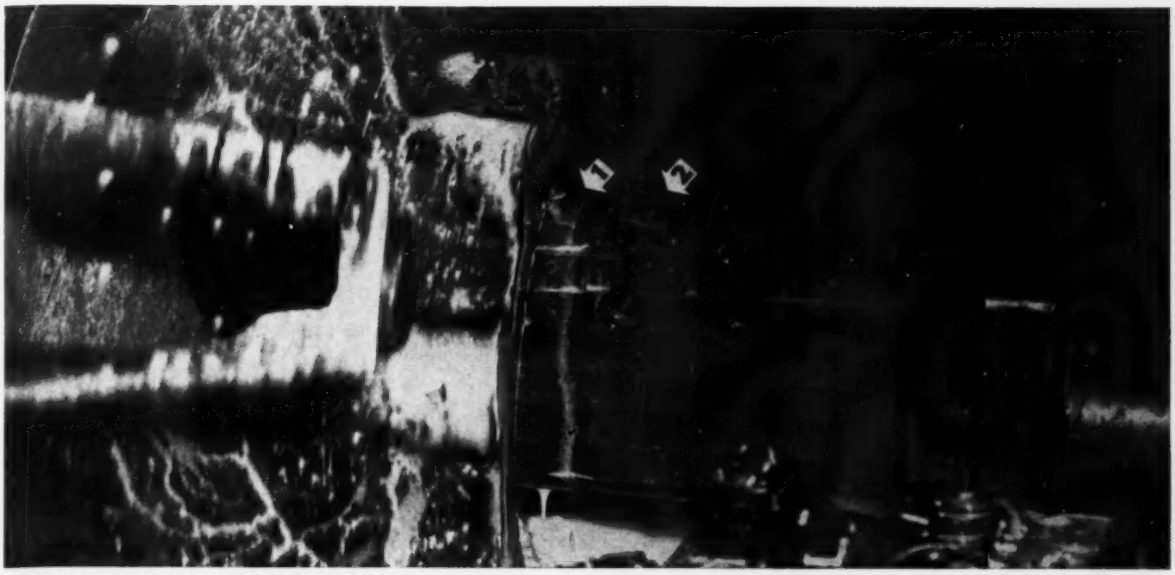
THREADING DEEP—In the production of Massey-Harris tractors at Racine, Wisconsin, Besly Taps prove their accuracy and stamina in tapping tough cast iron—one of the most severe tests of tap quality and endurance. On this automatic machine, equipped with Besly Taps, 16 deep bottoming holes are threaded in tractor frames in one operation. Besly Taps met these exacting specifications with clean-cut, economical threading.



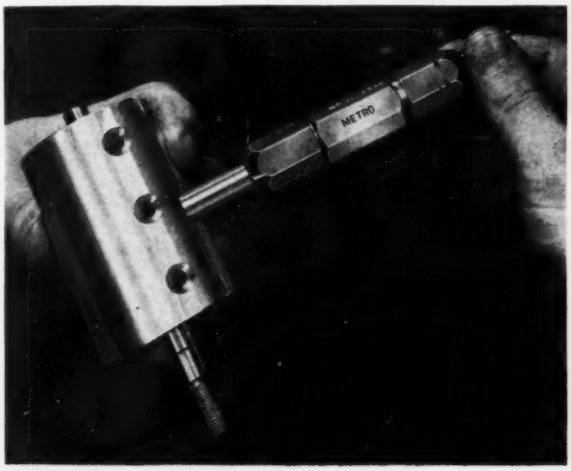
SQUARED OFF—Templeton, Kenly & Company, Broadview, Illinois, cuts heavy, almost square threads in malleable iron bases of rugged 12 to 24-ton capacity screw jacks with Besly acme taps. Notice mirror finish on flutes which promotes greater chip clearance, cleaner cutting. By using Besly's Engineering Service, this company realized lower costs and a better job. The right taps were matched to the specific workpiece.

MODIFIED TO FIT—The Gabriel Company, Cleveland, requires two concentric tapped holes in die-cast aluminum pistons used in their airplane type shock absorbers. Originally these were tapped individually—requiring 18 seconds per piece. To reduce this time, a unique set-up using Besly Taps was developed. A smaller Besly Tap is fitted inside the bored-out center of the larger Besly Tap. Two holes are now accurately tapped simultaneously in 9 seconds.

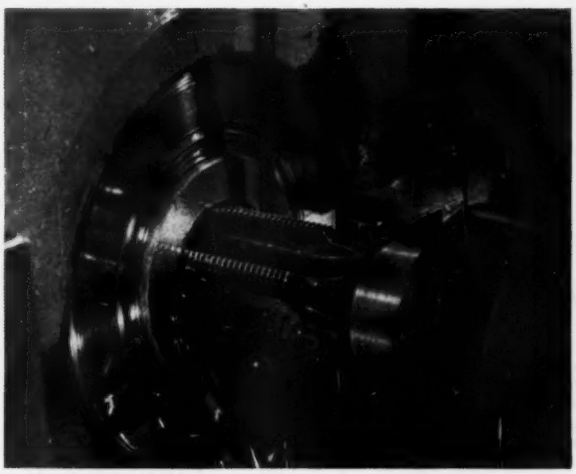
Methods . . . by BESLY



CARBIDE TOOLS IN ACTION—Heavy duty cast steel truck wheels manufactured and machined at Gunnite Foundries, Corp., Rockford, Illinois, are rough bored with a Besly BL-12-B5 Standard Carbide Tipped Tool, removing 1/8" — 3/8" of stock. On the same turret lathe a second Besly AL-12-B5 semi-finish bores, removing .030 stock. Metal removal is at 200 S.F.M. at .016 feed. First tool, arrow 1, is now about one-third through its job. Second tool, arrow 2, is set slightly higher in the same set-up for semi-finishing and follows the first tool. Besly's Engineering Service helped to achieve this set-up with the correct carbide tooling for efficient, low cost metal removal.



ASSURED ACCURACY—To assure that holes in planer cutter head assemblies provide precise fits for set screws, SKIL Corporation, Chicago, checks for accuracy with Besly-Metro Double End Reversible Cylindrical Plug Gages. Two opposed blades have three holding set-screws and another for adjusting position.



TOUGH GOING—Here you see a C-1018 high carbon steel nut being threaded by a Besly 1¾" tap. Extremely abrasive, because it has been carburized and heat treated, the material is difficult to tap. However, Besly taps tested on the work proved they could take it and were specified by the manufacturer.

Prove to yourselt that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. It you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details, or write us . . .

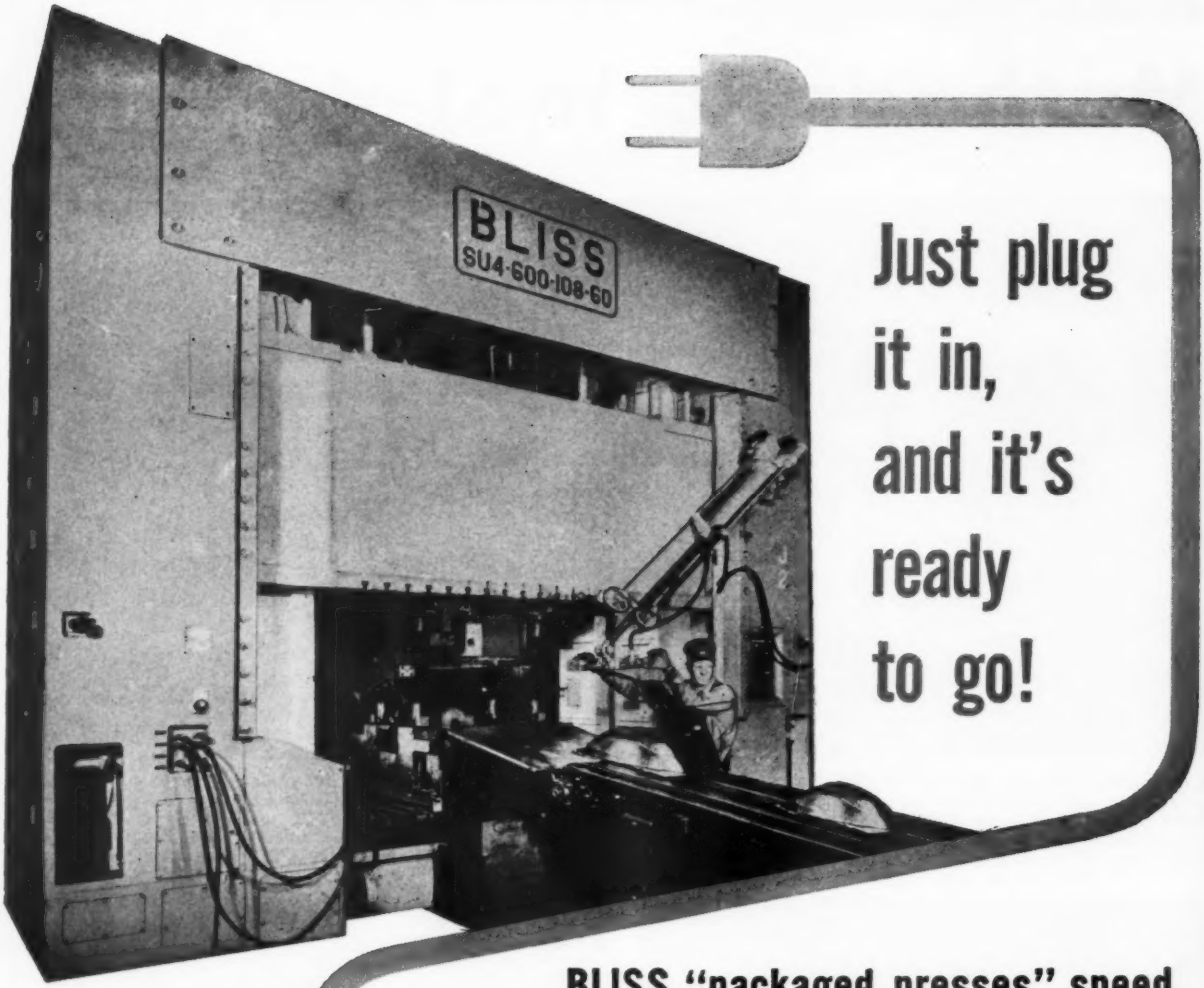
Engineering, Service and "Specials" . . . are a Besly Specialty

BESLY

BESLY-WELLES
CORPORATION
Est. as C. H. Besly & Co. 1875
128 Dearborn Ave., South Beloit, Illinois

TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, THROWAWAY INSERTS and HOLDERS

CIRCLE INFORM-A-GRAM KEY NO. 145



Just plug it in, and it's ready to go!

NEW AUTOMATION CONTROL

This new nine-station rotary limit switch will control stops, starts, interlocks, motion, time, or recycles of auxiliary equipment. Each station can be set from 0° to 360°, can be operated either normally-open or normally-closed, and is accurate within less than 1°. Write for Bulletin 33.

BLISS "packaged presses" speed installation and simplify maintenance

Automation created the problem—The dopers, kickers, lifters and other materials handling devices so popular these days brought a maze of wires and pipes in their wake. And aside from looking untidy, they slowed maintenance and proved annoying to crane operators.

"Packaging" solved it—Now, in Bliss' new line of presses, all the pipes and wires, and controls are built into the uprights. Each air and electrical line is tagged—simple to find, simple to fix. Controls are centrally located. The exterior is clean and uncluttered—cranes can move up close to change dies.

Bliss designers have come up with completely new two point and four point presses—both single action and multiple action. Design features include extremely rigid frames, eccentric drives, high speed clutches, extra long connections, motorized adjustments and many others. The entire line of presses is described in a comprehensive 32-page catalog, No. 11-B, just published. Copies for you and your staff are available by writing to E. W. Bliss Company

BLISS
SINCE 1857

is more than a name...it's a guarantee

E. W. BLISS COMPANY, Canton, Ohio

Presses, Rolling Mills, Rolls, Special Machinery

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, Cal. *Branch Offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France.
Other representatives throughout the world.

CIRCLE INFORM-A-GRAM KEY NO. 146

Now semi-finish machined all over

to save your machining time and reduce waste

AMPCO METAL GRADE 18 CENTRIFUGALLY CAST STOCK BARS

Ampco Grade 18 Stock Bars are now labeled on one end, for convenience in stocking. Labels show I.D. and O.D. sizes to which bars finish.

14 New Sizes! Sizes now range from 1¼" to 8" I.D., 1¾" to 10" O.D. 12½" lengths.

Purchasing Simplified! Stated sizes are now the sizes to which bars will finish.

New Convenience! Finish allowance, 1/16" on the diameter, both O.D. and I.D. You need make only finish-machine cuts.

Same Dependability! Ampco Metal Grade 18 is a unique aluminum-bronze alloy that resists wear, withstands shock and impact, lasts many times longer than ordinary bronzes. Ideal for bearings, bushings, gears, other parts.

Stock the sizes you ordinarily use in maintenance and tooling — and get other sizes promptly from your nearby Ampco stocking distributor.

Write today for new stock list.

D-58

AMPCO METAL, INC.

Dept. TP-4
Milwaukee 46, Wis.
West Coast Plant
Burbank, California

Why NEW "150" HYDROHONER Is Economical . . . Compact . . . Standardized

Basic Micromatic "150" Machine, suitable for both internal and external Microhoning.

Now, even manufacturers with limited capital can afford Microhoning . . . with all its benefits including efficient stock removal, accurate geometry and controlled surface finish. The new Micromatic "150" Hydrohoner is the answer!

Because it is standardized and produced in quantity, this quality machine is economical. (Special engineering is limited to tooling and fixturing.) The design and quality of the "150" assures performance equal to more expensive honing machines. It has a 12" stroke and Microhones diameters up to 1½" . . . yet requires just 34" x 52" of floor space.

The Micromatic "150" is ideal for the manufacturer with limited capital, short production runs or a need for standby equipment. Immediate delivery from stock on basic machines.

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision"... available at your request.

☐ Please send me "Progress in Precision" in time for showing on_____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME_____
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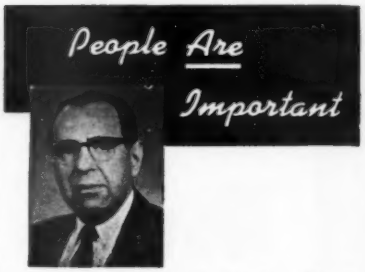
CITY_____ ZONE_____ STATE_____ E

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN



by Erwin K. Taylor, Ph. D.
President
PERSONNEL RESEARCH AND DEVELOPMENT CORP.
Cleveland 20, Ohio

FISHING FOR FOREMEN

IN THE MARCH ISSUE of *Tooling & Production,* "People are Important" discussed the need to analyze systematically the nature and level of the functions that first-level supervisors perform. We gave a number of examples of the kinds of questions that management should ask itself about each foreman's job. If you are inclined to dig a little more deeply into this area, we suggest that you latch onto a copy of the book called "The Foreman on the Assembly Line" by Walker and Guest. It was published by the Harvard University Press in 1956 and presents a rather intensive analysis of a group of first-line supervisors in an automobile assembly plant in the East.

If you make an analysis such as we suggested last month, you may be surprised by two results that you are quite likely to discover among your own people. First, you are likely to find that there is quite a difference between the duties and requirements of foremen's jobs that you had previously considered quite similar. Secondly, you may be surprised to discover how little time the average supervisor has for actually supervising in comparison with the amount spent on other duties that you may have previously considered incidental to his main responsibility and not very time-consuming.

Even after you have systematically determined what your supervisors have to do, you will still be a long way from having a selection procedure that will pick men who can perform these tasks adequately. If you have a large organization with a number of foremen having identical or quite similar jobs and a qualified personnel or industrial psychologist at your disposal, you have the basic ingredients for performing the neces-

sary research to give you a scientific answer to the problem.

Only a minority of managements, however, will have enough foremen in similar positions to take this approach. The smaller, more diversified organization will need to proceed on the basis of sound judgment and broad experience. First, in either case, it will be necessary to translate job activities and requirements into the needed aptitudes, skills, and personal characteristics desired. And secondly, there is a need to develop selection procedures that will predict successfully the extent to which each of the candidates being considered possesses the desired attributes.

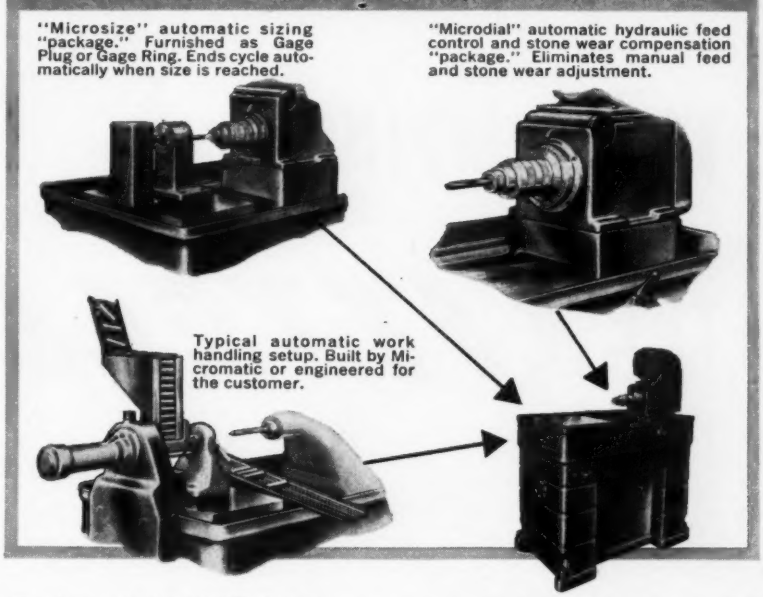
Here again the services of a personnel or industrial psychologist can stand you in good stead. To take advantage of his specialized training and experience, it is not necessary that your company be large enough to employ him on a full-time basis. There are a number of highly competent industrial psychologists working with consulting firms and on college faculties that are available to industry at quite a reasonable rate on a part-time or consulting basis. The Division of Business and Industrial Psychology of the American Psychological Association is currently in the process of preparing its 1957 Directory of Members. As Secretary of this division of the American Psychological Association, I shall shortly have available for free distribution a number of these directories. If you should like to have one, I'll be glad to send it to you if you will drop me a line asking for it.

The predictors of successful supervisory performance fall into three groups. First, there are those that can be measured through the use of background information and the usual types of psychological tests. Secondly, there are some that can be observed during a man's performance at his job as an hourly worker. And finally, there are attributes that the usual types of psychological test have not been too successful in measuring and which do not evidence themselves in the normal course of the working day. These, unfortunately, are sometimes the characteristics that are most important to supervisory success or failure. To attempt to measure them, more sophisticated techniques like the projective devices and especially designed interviews, administered by technically trained personnel, may be indicated.

In the selection of first-line supervisors, I am inclined to recommend a "successive hurdle" approach. By this I mean that measurements are made first on the most easily measurable of the attributes believed to contribute to the success or failure

. . . Continued on Page 156

How NEW "150" HYDROHONER Can Be Automated to Any Degree . . . Easily . . . Economically


"Microsize" automatic sizing "package." Furnished as Gage Plug or Gage Ring. Ends cycle automatically when size is reached.
"Microdial" automatic hydraulic feed control and stone wear compensation "package." Eliminates manual feed and stone wear adjustment.
Typical automatic work handling setup. Built by Micromatic or engineered for the customer.

The basic Model "150" Hydrohoner is a new, standardized and economical Microhoning machine . . . priced for manufacturers with limited capital or relatively short production runs.

The basic machine features automatic stroking and hydraulic initial tool expansion and collapse. Various degrees of automation can be easily added at any time to the basic machine as required by individual manufacturers' needs. Micromatic "package units" which provide specific automation functions are illustrated. Design of this basic horizontal machine and its stationary bridge facilitate addition of these "package units". For complete automation of the "150" Hydrohoner, Micromatic will build automatic work handling devices or assist users in designing their own automation of work handling.

Send coupon for complete information.

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

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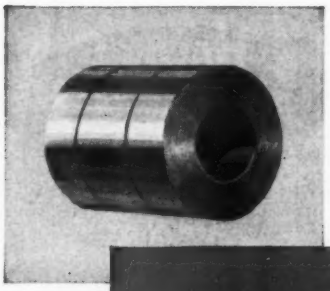
CIRCLE INFORM-A-GRAM KEY NO. 149

FROM COIL..



TO STAMPING..

THE *LITTELL* LINE

Speeds Production, Cuts Cost

Ever since the first coil stock came out of the mill, Littell straightening and feeding equipment has made it practical and profitable to use. The pioneers of low cost, automatic punch press operation depend on Littell Hooks, Reels, Straighteners and Roll Feeds today, as they have from the start. The Littell line has grown up with the needs of the modern pressroom to become the complete line, the standard-bearer of its field. You will find in Littell equipment the key to more flexible, more productive, and more profitable operation in your own pressroom.

No. 418-HRP HYDRAULIC DRIVEN FEEDING AND STRAIGHTENING MACHINE
Automatically straightens coil stock and feeds to any type punch press or square shear. Handles stock up to .125" thick. Feeds up to 19" lengths at 40 strokes per minute, or up to 38" lengths at 20 s.p.m. Easily moved from press to press by fork truck or crane. Operated independently. Fully described in Bulletin B-10.

HOOKS . . .
with coil lifting capacities of 1,000 to 40,000 lbs.

REELS . . .
Spindle Reels with coil capacities from 300 lbs. to 40,000 lbs. Coil cradle reels for coils up to 30,000 lbs.

STRAIGHTENERS . . .
straighten coil stock from 1" to 90" wide, from .010" to .125" thick.

AUTOMATIC ROLL FEEDS
. . . serve all types of presses, handle all widths and thicknesses of stock. Used with compound, single and progressive dies.

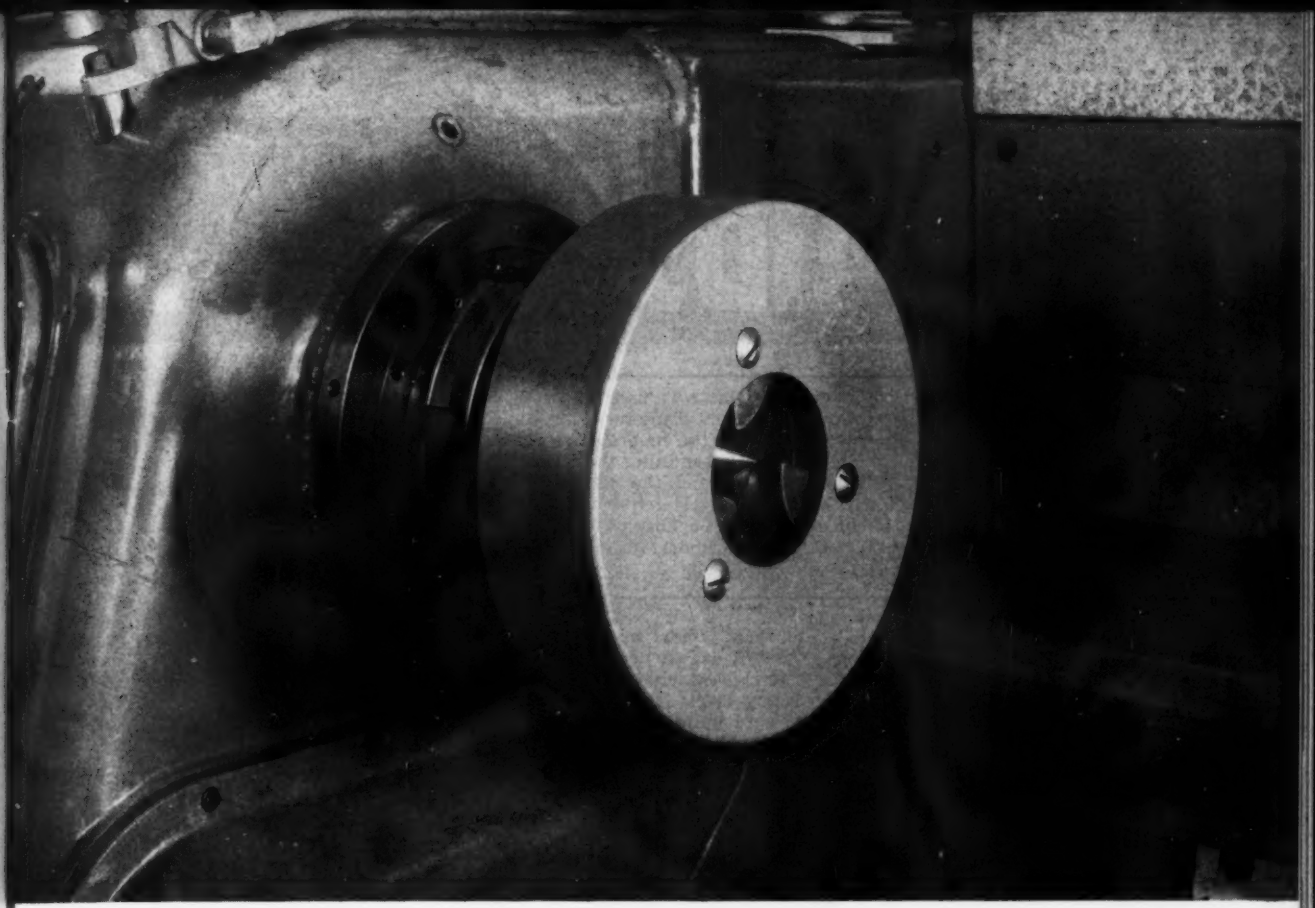
F. J. LITTELL MACHINE CO.
SPEED WITH SAFETY

REELS · STRAIGHTENING AND FEEDING MACHINES · SHEETING LINES · ROLL FEEDS · COIL CRADLES
DISTRICT OFFICES: DETROIT, CLEVELAND

4197 N. Ravenswood Ave. • Chicago 13, Illinois

THE LITTELL CATALOG No. 56 tells the complete story. Write for your free copy.

CIRCLE INFORM-A-GRAM KEY NO. 150

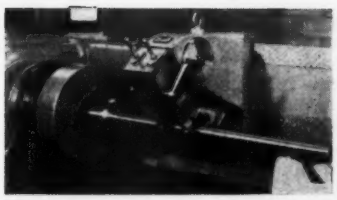


This time saver will quickly pay for itself in your plant

For turning between centers, give your present lathes the time-saving advantages of the same **+GF+** Work Driver used on the world famous George Fischer Lathes.

It clamps and unclamps with a slight turn of the hood. Clamps rough or smooth blanks and out-of-round forgings evenly. Automatically matches clamping force to cutting pressure. No fussing with driving dogs, no time-wasting hand wrenching.

Five models of the **+GF+** Work Driver give you diameter capacities of 1/4" to 8-1/16"— each model drives a wide range of diameters. Write for the **+GF+** Work Driver Bulletin, which gives full information, specifications, and applications. Write Dept. 194



Best way of all to drive out-of-round forgings and other work pieces. Jaws are held in a floating ring which fits them to the work piece and drives with evenly distributed force.

A half-turn of the hood engages or releases the jaws — no wrench needed. Jaws can easily be set to drive in either direction. Hood is easily removed for changes to jaws accepting different diameters.

Skinner Chuck Company is national distributor for the +GF+ Work Driver. Sales are handled through Industrial Distributors, Machinery Dealers, and Machine Tool Builders.

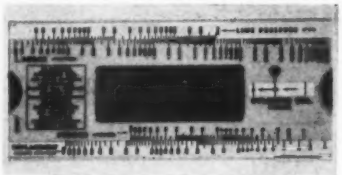
SKINNER CHUCKS

THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT

SHOP AIDS



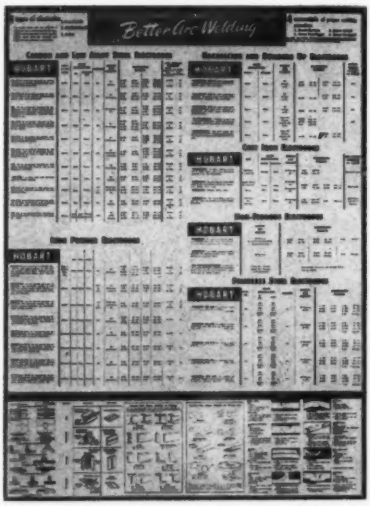
This Calculator is used for computing cylinder diameter and displacement. On the reverse side data is given for determining the time in seconds/stroke and the oil velocity in the pipe. Direct requests for the calculator to Logansport Machine Co., Inc., Logansport, Ind., or — **Circle Inform-A-Gram No. C1.**

A Technical Data Sheet details Adhesive EC-1357 manufactured by Minnesota Mining and Mfg. Co., 411 Piquette Ave., Detroit 2. This elastomeric adhesive is used for contact and hot bonding a wide variety of porous and non-porous surfaces. The data sheet lists the properties and advantages of the adhesive. In addition, the application of Adhesive EC-1357 is covered in detail. Copies of the Technical Data Sheet are provided by the company, or — **No. C2.**

An Electrode Data Book has been prepared by National Cylinder Gas Co., 840 N. Michigan Ave., Chicago 11. Included is information on AWS-ASTM arc welding electrode specifications, how to estimate electrode consumption, a summary of welding symbols and factors in selecting electrodes. Also covered are factors affecting weld qualities, carrying capacities of wires, and color identification of electrodes. Get your copy of 24-page Data Book NH-504 from the company, or — **Circle No. C3.**

A New Booklet on Machinery Parts made of Haynes alloys is now available. It has been expanded to include data on chemical compositions, physical and mechanical properties, corrosion resistance, and machining of the alloy parts. Separate chapters cover cobalt-base, nickel-base and iron-base alloys, and typical applications that fall within each group. Case histories are presented and parts shown including burnishing rollers, wear strips, valve seat inserts, battery machine parts, valve parts, half-bushings, half-sleeves and knives. Other sections detail procedures for heat-treating, machining, grinding and forming machinery parts made of Haynes alloys. Copies of the booklet are supplied by Haynes Stellite Co., 30-20 Thomson Ave., Long Island City 1, N. Y., or — **Circle Inform-A-Gram No. C4.**

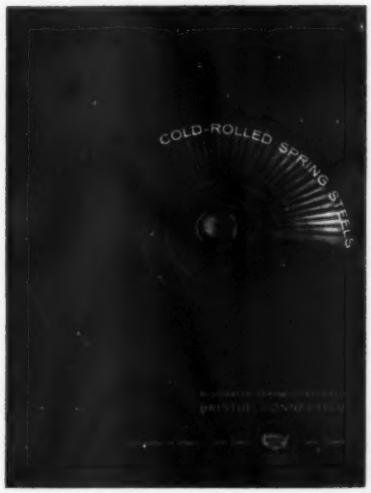
This Wall Chart on Arc Welding lists and gives instructions on the use of electrodes including carbon and low alloy steel, iron powder, hardfacing and build up, cast iron, nonferrous, and stainless steel. Also presented are the four essentials of proper welding procedure. In addition, the chart shows types of joints, typical welding positions, standard steel shapes, and causes of common welding troubles and what to do about them. Copies of the chart, Form EW-198, are issued by Hobart Bros. Co., Hobart Square, Troy, O., or — **Circle Inform-A-Gram No. C5.**



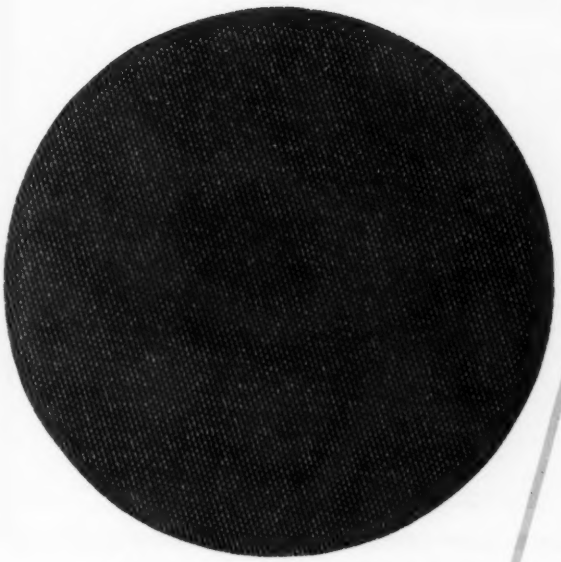
A Blue Data Sheet, "Allegheny Ludlum Stainless Steel Type 201," is now being distributed. Given is detailed information covering analysis range, resistance to corrosion and oxidation, and physical and mechanical properties. Sections are also included on the welding characteristics and fabrication of the steel. For copies of the Blue Data Sheet, contact Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, or— **Circle Inform-A-Gram No. C6.**

A Guide to Carbide Die Sharpening Procedure points the way to faster, better, and easier grinding. Discussed in the illustrated publication are sharpening equipment, wheel selection for proper carbide die sharpening, speeds and feeds, and check for run-out. In addition, dressing the diamond wheel, inspection prior to grinding, and sharpening the die are covered. Copies of Bulletin 356, a supplement to "Precisioneering and Productioneering Oberg Carbide Dies," are supplied by Oberg Mfg. Co., Inc., P. O. Drawer 231, Silverville Rd., Tarentum, Pa., or — **Circle Inform-A-Gram No. C7.**

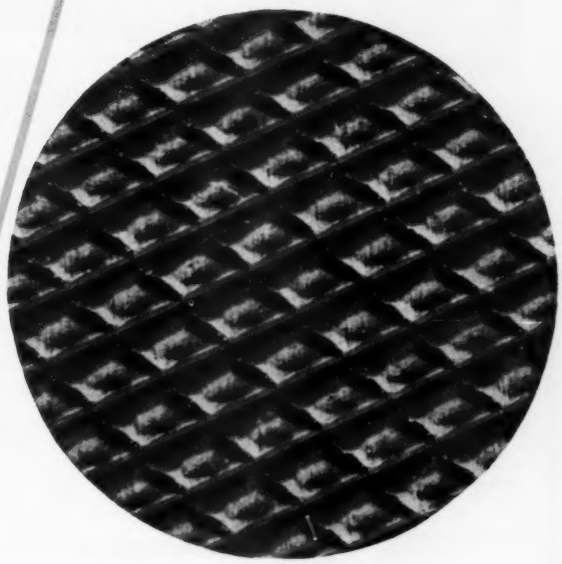
"Fact Book of Cold-Rolled Spring Steels" aids in selecting the best cold-rolled spring steel for a specific requirement. This 48-page brochure not only gives sizes, grades and hardnesses of steel, but also covers essential qualities; the various grades and what each is most commonly used for; and how spring steel is rolled, annealed, slit and filed, hardened and tempered, polished, colored and inspected. Included are practical hints on blanking and forming parts from spring steel. Given are six pages of physical property charts for determining the correlation between thickness and tensile strength for two common analyses of steel in three conditions of hardness, and forming and bending characteristics of the same material. Obtain copies of the Fact Book from Associated Spring Corp., Bristol, Conn., or — **Circle Inform-A-Gram No. C8.**



For the finest jobs...or the roughest jobs



Tooth pattern of Nicholson-made Swiss Pattern Square Handle Needle file, Cut No. 6, magnified approximately five times.



Tooth pattern of Nicholson-made 18-inch Flat Bastard file magnified approximately five times.

There is a Nicholson and Black Diamond file for every purpose

Examine these close-ups carefully. They show several important points.

First, they indicate that Nicholson-made files are available in the widest spectrum of cuts. The cross section at left is magnified from our X.F. (*Ex*tra *F*ine) Swiss Pattern Square Handle Needle file, Cut No. 6, the finest cut we make. Our X.F. files are primarily finishing tools, used by tool and die makers, delicate instrument parts finishers and jewelers. And there are *seven* separate degrees of fineness instead of the three usually found in conventional American pattern files.

The section at right is from our 18-inch Flat Bastard file. This rugged tool is used by machinists, ship and engine builders, repair men—any worker who wants to take off a lot of metal in a little time.

Secondly, notice the uniformity of tooth structure. It's just as uniform in the fine Swiss Pattern cut as it is in the big Flat Bastard. That means topnotch workmanship by Nicholson . . . and topnotch results in your shops. Always specify Nicholson or Black Diamond files.

NICHOLSON U.S.A.

NICHOLSON FILE COMPANY, PROVIDENCE, RHODE ISLAND

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

BLACK DIAMOND U.S.A.

NICHOLSON FILE COMPANY

World's foremost manufacturer of A FILE FOR EVERY PURPOSE

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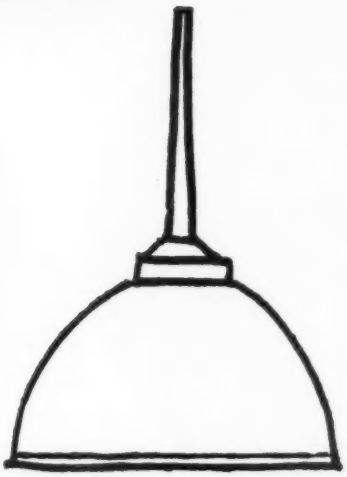
DROODLES

by ROGER PRICE

J&L



Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

"SPRING TONIC"

The subject of "oiling up" reminds me of my uncle Gus, the temperance lecturer. Over the years, he made a fortune denouncing the demon rum from the rear platform of a converted water wagon. His impassioned sermons were terror-inspiring, and men fought to enroll in his "Nay-Nay" Club at two bucks a head, for which they received a fancy certificate and a temperance badge. The crowds loved Gus, although they often commented on his odd habit of always munching oranges. I've often wondered what would have happened if they'd learned of Gus's other habit: privately hypo-ing each orange with a few cc's of gin. But, luckily for him, his secret never leaked out, and he continued to be a howling success.

All of which leads me to remind you, in my shy, roundabout way, that your quality control operations can be a howling success, with the help of J&L Optical Comparators. These remarkably precise measuring and inspecting instruments are being used throughout industry to assure accuracy of manufacture. The J&L Comparator rapidly inspects all sorts of parts and objects, in a variety of sizes and shapes. It's ideal for inter-operation inspection; and it's so flexible, it enables you to perform inspections that aren't possible by any other method. Available in eleven different models, both bench and pedestal types. Write for catalog today.

JONES & LAMSON OPTICAL COMPARATORS *On the Job . . .*

at John Dusenbery Co., Inc.
Verona, N. J.

This company, manufacturer of Dusenbery Converting Equipment, uses and recommends Jones & Lamson Comparators for inspecting the precision of knife grinding operations. The comparator, with a visual power magnification of 62½ X, projects the image of the knife edge on a grid screen showing exact radius dimensions to 1/1000 of an inch. The comparator has been found to be the only device capable of accurately checking knife edge radii.

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 519 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

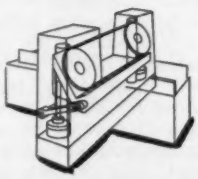
name _____ title _____ street _____

company _____ city _____ zone _____ state _____

Heavy Cut-off Work Now Done with Band Sawing Economy

Forge Blocks
Rounds · Bars
Tubing · Pipe
Structurals

DoALL
POWER SAW
24" x 24" Capacity
HEAVY DUTY Horizontal CUT-OFF SAW



HORIZONTAL SAWING HEAD
Unique design insures ample power and rigidity for new rugged beam 2" wide Demon HSS Saw Band. You get heavy cuts at high speed, long band life at low tool cost.

New Design packs power, rigidity and speed for the big cut-off jobs.

Here's a machine that was designed *from the ground up* to meet a growing need by steel mills and warehouses, shipyards and other fabricators for high speed, dead accurate cut-off of heavy work pieces.

The new DoALL Power Saw Model 24 packs power, rigidity and speed behind a new rugged, continuous cutting 2" wide Demon HSS band. It will cut heavy bars, pipe, billets and structural shapes in a fraction of the time *at a fraction of the cost* of any cut-off machine of comparable capacity. And the narrow-kerf cut will give you a bonus of many more cuts per piece in material savings alone!

Its revolutionary horizontal design results in a combination of structural simplicity, speed and accuracy of cut with new ease of handling heavy work. Variable speed, fluid drive, complete automatic operation, automatic indexing of blanks up to 12' long, and power positioned hydraulic vises are just a few of the revolutionary time and money saving features of this new Power Saw. Call your local DoALL Sales-Service Store for details on this outstanding investment today or write: The DoALL Company, Des Plaines, Ill.

FEATURES

- *Finger tip control* for instant response to change in speed or direction. (Manual control also available.)
- *Powered rollers* position the heaviest work pieces
- *Fluid drive speed control* meets broad range of cutting requirements.
- *Automatic indexing table*
- *Power positioned hydraulic vises*
- *Automatic self-drain chip removal*
- *Positive feed coolant system*

For Lowest Cost . . . do it on the DoALL!

FS-5

CIRCLE INFORM-A-GRAM KEY NO. 155

. . . Fishing, from Page 148

of a foreman. Those who show promise on the basis of such preliminary measures can be earmarked as potentially promotable at an early stage of the game and their performance and development carefully watched. Care must be taken however, under such circumstances, not to eliminate from consideration those whose deficiencies are due to lack of experience or specialized training that they will acquire on the job.

The ideal time, of course, at which to collect the kind of information that constitutes the first hurdle, is during the initial selection process. During this period of labor shortage, there has been a general tendency for companies to hire (particularly hourly) workers with a minimum of information about them. I have been astounded in several instances recently with how little some personnel departments knew about the people who worked for them.

While it is true that job applicants may in some instances balk at the idea of subjecting themselves to several hours of testing on their own time, few if any will offer resistance to the testing program and collection of personal history information that is made a part of the company's indoctrination and orientation program. Professional training is not required for the administration and scoring of most of the psychological tests that would be used at this point. Almost any bright, conscientious and mature individual can be taught these procedures in a matter of hours.

Interpretation of the background information on new hirees and their test scores is quite another matter. This is something that should be entrusted only to the qualified personnel psychologist or to one with equivalent technical training.

I would also recommend securing a high-school transcript, and where appropriate a college transcript, on every man hired. Such records will not only provide information with respect to his learning ability but will also shed light on the areas of his strength and weakness. It will also serve to verify the educational information supplied by the applicant on the personal history form. Testing at this point, in addition to identifying new hirees with promotional potential, will provide several valuable by-products. Where jobs are open in several different departments, they may be quite useful in indicating the most profitable placement of each individual. Secondly, they can help to spot the few individuals who perhaps never should have been hired and who should consequently be watched carefully throughout their probationary period to make certain, before they acquire

Here, for the FIRST Time . . .

IS A TAP SPECIFICALLY FOR SCREW MACHINES.

This new high speed steel, ground thread tap with its short thread length, spiral point, and specially heat-treated necked shank cuts cleaner threads, has longer life, reduces bellmouth condition and tap breakage . . . and pays big dividends in improved work quality, increased output, and lower tooling costs! Tests prove that performance is excellent on practically all machinable metals. Plug and bottoming types in machine screw sizes No. 2 to No. 10 . . . available *now* from stock at the P&W Branch Office near you. Write for complete information. *Pratt & Whitney Company, Inc., 15 Charter Oak Boulevard, West Hartford, Connecticut.*

• THREAD ROLLING DIES • DUOCONE DIES • TAPS • THREAD MILLING CUTTERS • REAMERS . . .

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

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a vested right to continued employment, that they are capable of performing productively even at the hourly level.

What background information should be collected, what tests if any should be used, and what levels of performance are to be expected will of course differ in each situation. They will be a function of the results of the systematic review of the requirements of the supervisor's position. But they constitute a first and relatively inexpensive hurdle in the foreman-selection procedure, and they guarantee to some extent that some of those who are potentially desirable supervisors will not be overlooked in the shuffle.

In the May issue of *Tooling & Production*, this column will turn its attention to the second hurdle in systematic supervisory selection — the measurement of on-the-job performance and behaviors that predict later success as a foreman or a supervisor.

BORING MACHINE FOR COMPRESSOR CRANKCASES

Specially designed for boring two different sizes of 4-, 6-, and 8-cylinder compressor crankcases to receive cylinder sleeves, Moline's Model MR149 single spindle machine features completely automatic operation once the part is loaded into the fixture.

The horizontal boring spindle unit moves by hydraulic power on hardened and ground steel ways and is provided with rapid traverse in two directions, adjustable rate of coarse feed for boring, and adjustable rate of fine feed for facing, together with timed dwell against a positive stop for cleanup of facing to depth.

After a crankcase is loaded into the fixture, it is located and clamped endwise by hydraulic power. The automatic cycle then is started, with boring and indexing following a preset sequence until all operations are completed. As soon as the tools are withdrawn at completion of work on a bore, the crankcase is indexed longitudinally and radially as required to bring the next hole into position for boring. After all holes have been bored, the fixture indexes the work into position with feet down, ready for unloading.

Operations include rough bore, counterbore top and bottom bores, and face bottom bores. Changeover, from one size crankcase to another can be accomplished in a matter of minutes.

210,000 HOLES . . .

AND STILL RUNNING!

120,000 pieces before the first grind . . . 90,000 after grinding . . . and still producing accurately threaded holes! These are the actual performance figures reported by a satisfied user of P&W Taps. Performance like this is possible, because P&W Taps are *always* accurate, always concentric with shanks, threads, OD's and chamfers . . . *all* ground *on centers.*

When you buy taps, *you're really buying the number of finished workpieces they'll produce.* That's why Pratt & Whitney Taps and other Cutting Tools are your best buy. Complete lines available from stock at the P&W Branch Office near you. Write for full information. *Pratt & Whitney Company, Inc., 15 Charter Oak Boulevard, West Hartford, Connecticut.*

. . . MILLING CUTTERS • CUT-OFF BLADES • END MILLS • KELLER CUTTERS • KELLERFLEX BURS

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FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

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Now... Gorton Milling Machines Feature Hydraulic 3-Dimensional Controls

"Pencil Pressure" Does the Work

Gorton now offers you several models of Super-Speed Vertical Mills equipped with sensitive and accurate hydraulic controls featuring feeds up to 40 inches per minute.

AVAILABLE 3 WAYS

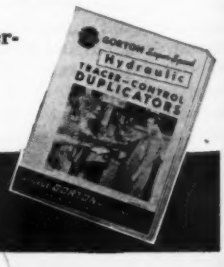
1. **Vertical action only**
2. **Cross and longitudinal**
3. **Three-dimensional combination**

Gorton Milling Machines with hydraulic Tracer Control must be ordered as such. Hydraulic equipment is not an attachment but a permanent installation.

For die or mold work (single or multiple units), production profiling and duplicating — short runs, experimental pieces or high production.

Gorton also offers manual and automatic Tracer-Controlled Milling Machines and Pantographs for 2- or 3-dimensional operation; 1 to 1 ratio, or reproduction at variable reductions, with single or multiple-spindle machines for work of any shape or size.

Shown above: Gorton 9-J Super-Speed Vertical Mill with True-Trace hydraulic installation.



Write for Bulletin 1204

GORTON

GEORGE GORTON MACHINE CO.

1204 RACINE STREET • RACINE, WISCONSIN

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A 8731-1PR

CIRCLE INFORM-A-GRAM KEY NO. 158

R-B Strippers Cut Costs

RUBBER STRIPPER

Stripping with R-B rubber strippers or R-B rubber covered spring strippers eliminates costly metal strippers. Both types of R-B strippers serve the same purpose—rubber strippers are used with smaller punches having shank diameters up to and including ⅝"; rubber covered spring strippers are recommended for punch shank diameters larger than ⅝". Use R-B strippers—to save the cost of making strippers—to substantially reduce installation time—for reduced maintenance.

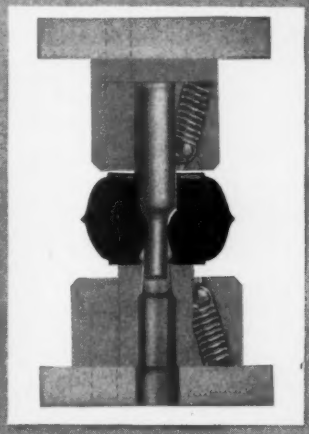
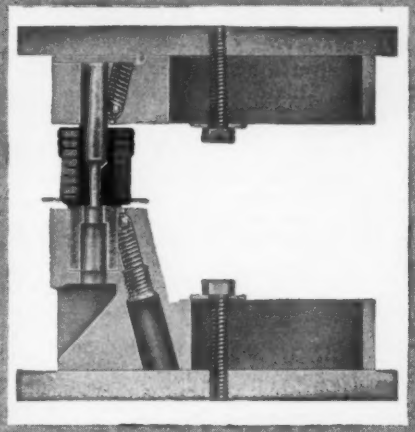


Illustration above shows rubber stripper on punch shank. In this type of application R-B strippers are held to punch shank by friction.

RUBBER COVERED SPRING STRIPPER

To the right is a cross section illustration showing how rubber covered spring strippers (also rubber strippers) are used with R-B Flex-Mount retainers.



No other manufacturer of punches and die buttons can offer you the amount of successful application experience and the scope of knowledge that is available from the R-B engineering staff.

Use R-B Engineering Service for Your Piercing Problems

RICHARD BROTHERS PUNCH DIVISION

ALLIED PRODUCTS CORPORATION

DEPT. 90 • 26476 CAPITOL AVENUE • DETROIT 29, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 159

DIRECTORY OF METALWORKING MACHINERY, 1956 Revision. Published by the Departments of the Army, Navy, and Air Force, Department of Defense, Washington 25, D. C., 1956. Approximately 2,000 pages, $6.50.

This complete revision of the 1951 Directory provides a uniform method for classifying Department of Defense metal cutting and metal forming machine tools. It obsoletes the 1951 Directory and the 1952 and 1953 Addendums.

The one volume directory is divided into three sections: Section I gives machine tool manufacturers' machine listings, alphabetically by company name; Section II, listings of manufacturers by machine types; and Section III, an index of manufacturers sequenced numerically by the Department's Federal Supply Code for Manufacturers, Cataloging Handbooks, H4-1, H4-2.

HOW-TO-DO-IT PICTURES, First Edition. Published by Eastman Kodak Co., Rochester 4, N. Y., 1956. 60 pages, 50 cents.

How-to-do-it pictures are used extensively in industry — for instruction, training, advertising, and publicity purposes. This Kodak paperbound book tells and shows how to prepare for, take, and use such photos.

Special sections deal with equipment, backgrounds, script and subject preparation, special techniques, and print captioning and mounting. The book's written so the "do-it-yourselfer" can take how-to-do-it photos.

MANUFACTURING METHODS AND PROCESSES, by Arthur C. Ansley. Published by Chilton Company, Philadelphia 39, Pa., 1957. 561 pages, $12.50.

This one-volume guidebook of production covers briefly these subjects: casting processes, stamping, forming, forging, extrusion, powder metallurgy, ultrasonic machining, heat treating, plastics, assembly and finishing, inspection and gaging, woodworking, ceramics, electronic printed circuits, and automation.

It is not intended for experts in these fields, but rather to give a broad, yet briefly presented, picture of the latest overall developments in industry for persons in production, inspection, purchasing, sales, and engineering. Almost 800 photographs are used, showing both methods and machines of production.

DESIGN OF GRAY IRON CASTINGS, by Arthur Scharf and Charles F. Walton. Published by Gray Iron Founders' Society, Inc., Cleveland 14, Ohio, 1957. 46 pages, $3.

This paper-bound manual is intended for inclusion in the Society's Gray Iron Castings Handbook. It presents casting design from the design engineer's viewpoint, covering functional strength, performance, appearance, and economy. A two-page bibliography offers sources for additional information on the subject.

ESSENTIALS OF MACHINERY PROCUREMENT AND DEVELOPMENT, Special Report No. 14. Published by the American Management Association, 1515 Broadway, New York 36, N. Y., 1956. 71 pages, $2.50 (AMA members, $1.75).

To offset rising costs and reduce the amount of equipment made obsolete by technological change, management must plan intelligently for machinery replacement. It must understand the complex problem involved in purchasing and developing new equipment.

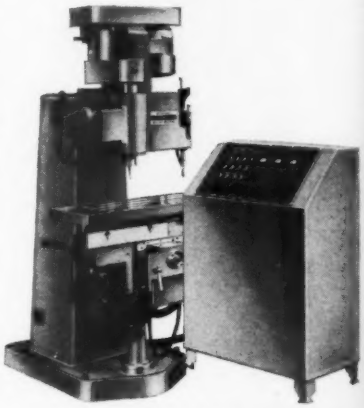
This new report, based on papers presented at an AMA conference, supplies practical, specific solutions to many of the questions posed by this problem. It includes a detailed presentation by Merck Sharp & Dohme (a Division of Merck & Co., Inc.) of its successful program for the acquisition of capital equipment. Company executives discuss the role of each department in carrying out the over-all plan. Other sections consider such important factors in machinery procurement as financial and tax considerations, techniques for safeguarding the buyer of equipment, procurement in a multi-plant company, and spending a limited equipment budget.

ORGANIZING FOR EFFECTIVE SYSTEMS PLANNING AND CONTROL, Special Report No. 12. Published by the American Management Association, 1515 Broadway, New York 36, N. Y., 1956. 192 pages, $4.50 (AMA members, $3.50).

Systems planning and control can be a major factor in the success of an organization. In fact, systems work in many firms includes the coordination of all managerial effort for improved efficiency and increased profit. The systems department may participate in all management activities, ranging from paper work procedures to the organization of top company policies.

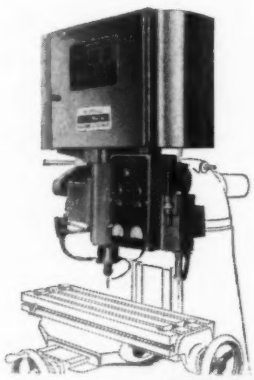
How this is actually done is described in this AMA report. Top executives of Lockheed Aircraft Corporation and Cleveland Electric Illuminating Company and other companies explain the operation of their systems departments.

REPRODUCE WITHOUT TOUCHING THE MODEL — WITH PRATT & WHITNEY VELVETRACE EQUIPMENT



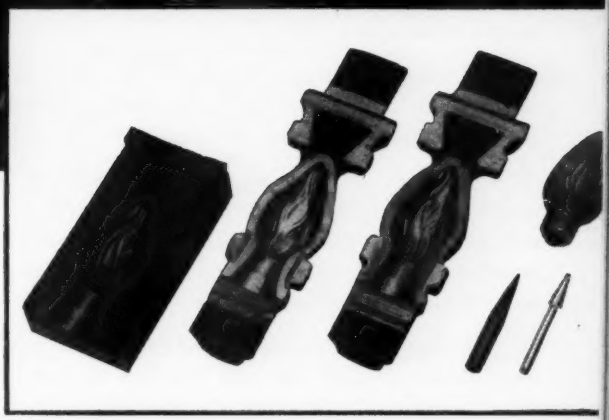
VELVETRACE® MILLING MACHINE . . .
Ultimate in accuracy for 3-dimensional tracer-controlled reproduction. Spindle speeds from 310 to 10,800 rpm. Work size capacity 9" x 12".

THE VELVETRACE DUPLEX ROTARY FIXTURE . . .
is easily mounted on the table of the Velvetrace Milling Machine. Offers faster setup and machining, and more desirable feed patterns, for milling a variety of linear or circular work.



VELVETRACE MILLING ATTACHMENT . . .
a complete, easily attached unit that brings the outstanding advantages of Velvetrace 3-dimensional tracer control to most conventional milling machines.

CIRCLE INFORM-A-GRAM KEY NO. 161



Putting PRECISION REPRODUCTION *in a New Light*

BECAUSE THE PRATT & WHITNEY "VELVETRACE"® MACHINE DUPLICATES THE FINEST DETAIL WITHOUT TOUCHING THE MODEL . . .

These flame-shaped light bulb molds, produced for Corning Glass Works, were machined with such fine detail on the Velvetrace that no hand finishing was required.
Ideal for your die, mold, prototype and other work, the Velvetrace employs a unique *non-contacting* tracer control that follows any 3-dimensional model without touching it . . . cannot damage your model, however soft or fragile, even when using the smallest diameter tracer points. Fully automatic operation with variable speed control to compensate for changes in contour, and a wide range of spindle speeds from 310 to 10,800 rpm insures you fast, economical production.

Write for complete information.
Pratt & Whitney Company, Incorporated,
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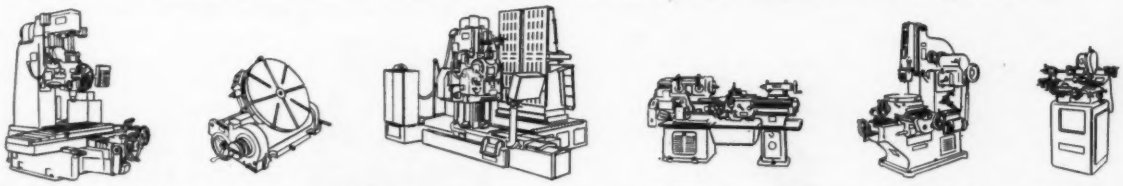


JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 161

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., 726 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

7 Tricks of the Trade in Jig Grinding Small Holes

The following tricks of the trade will prove helpful in jig grinding small holes with a diamond-charged mandrel:

1. Uniformly graded diamond powder should be used for charging mandrels. Holes from minimum (1/64") to about 3/32" in diameter should be roughed and finished with 80-100 grit powder. Larger holes may be roughed somewhat more rapidly with a coarser grade, 60-80 grit.

2. Avoid bellmouth by preventing the mandrel from leaving the hole at either end.

3. Since a freshly charged mandrel will cut much more rapidly than a worn one, avoid introducing a freshly charged tool as a hole nears size, Fig. 1.

4. Do not permit the uncharged *shank* of a mandrel to contact the surface being ground. Frictional heat will burn both the work and the mandrel. The former, partially annealed at point of such contact, will charge with diamond sut and probably be ruined.

5. It is generally more economical and efficient to consider mandrels as expendable and make a new one for each job. Since the cost is only a few cents, use of an old one, or even the time spent trying to match one to requirements, is hardly justified.

6. Because mandrels cannot be trued with a diamond, it is necessary to measure both the top and bottom of a hole while grinding, in order to avoid a ridge.

7. In view of point 6, it is advisable to set the work up on parallels of sufficient height to enable measurement from beneath the workpiece, Fig. 2.

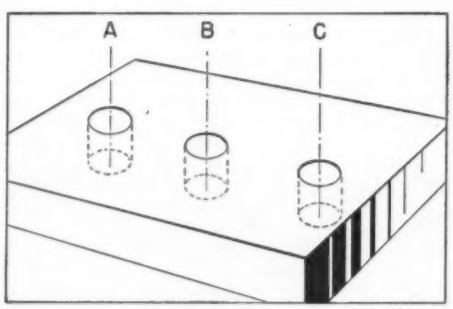


Fig. 1. In grinding three holes to size, A and B are roughed to within .001"–.002", and C within about .005". Using a freshly charged mandrel, C is finished to size, thereby breaking down the high points on the tool. A and B may now be safely ground to size.

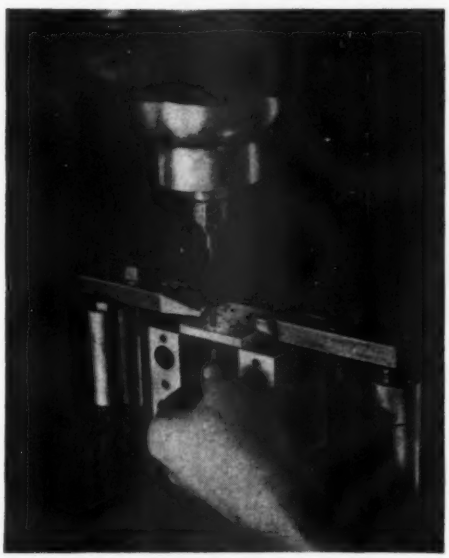
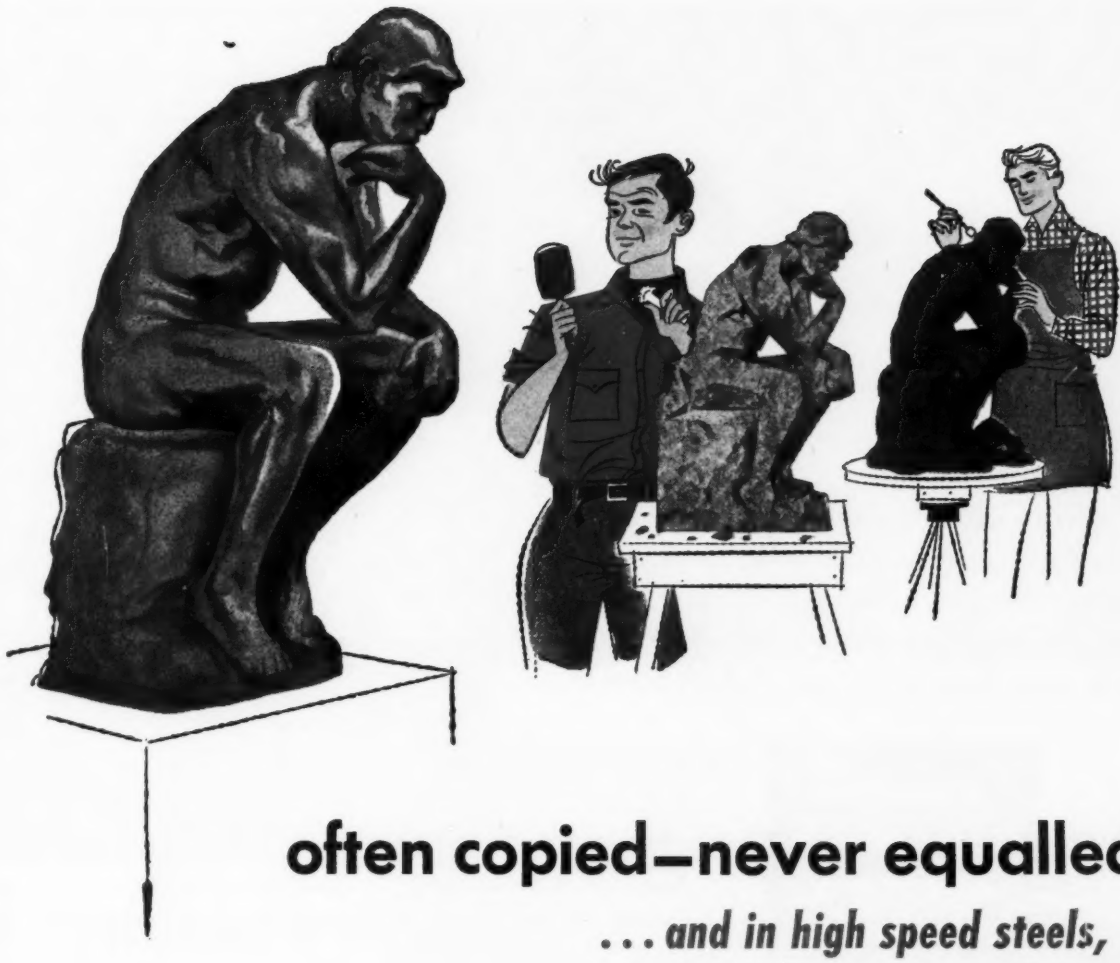


Fig. 2. Workpiece is mounted high enough to permit measuring bottom as well as top of hole.

Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 726 Union Ave., Bridgeport 7, Conn.



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Crucible's REX® high speed steel is in a class by itself—has been for more than half a century. And it gets better every year. New improvements in manufacturing techniques have brought even greater uniformity and quality to its well-known properties.

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You can get REX from stock from your nearby Crucible warehouse—or promptly by direct mill delivery. For further information on REX and the many other Crucible special purpose steels, send for the *Crucible Publication Catalog*—it's yours for the asking. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

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Crucible Steel Company of America

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Get finer accuracy plus
a guaranteed wear factor
at no additional cost!

Ellstrom chromium plated gage blocks are now unconditionally guaranteed to be "minus nothing" from nominal size in accordance with these exclusive new standard accuracy tolerances . . .

"W"—WORKING ACCURACY BLOCKS
Measured Length: +.000008"/—.000000"
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Measured Length: +.000004"/—.000000"
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• Available in standard sets of from 8 to 92 blocks in both square and rectangular styles with or without basic gage block accessories. Write for prices today!

Never before have gage blocks been offered as standard with all deviations unconditionally guaranteed to be on the "plus" side of nominal block size. And never before have you been offered these three exclusive benefits:

1 Positive assurance against receiving "minus" blocks . . . blocks that are actually "worn" undersize during manufacture before they are ever used.

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3 An absolute guarantee that every new Ellstrom gage block will start wearing *toward* its nominal marked size rather than *away* from it.

Bear this in mind, too. These are Ellstrom *Standards*, not special blocks. And they are available now at no increase in price to bring you even finer accuracy, longer useful life, and lower gaging costs.

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REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA
CIRCLE INFORM-A-GRAM KEY NO. 164

Coming Events

Apr. 2-4. Society of Automotive Engineers. Aeronautic Production Meeting and Forum. New York City.

•

Apr. 4. Cleveland Engineering Society. Industrial Management Conference. Cleveland.

•

Apr. 7-11. National Screw Machine Products Association. Annual Spring Meeting. Shoreham Hotel, Washington, D. C.

•

Apr. 8-12. American Welding Society. Spring Meeting and Fifth Welding & Allied Industry Exposition. Hotel Sheraton and Convention Hall, Philadelphia.

•

Apr. 9. Material Handling Institute. Spring Membership and Directors Meetings. Edgewater Beach Hotel, Chicago.

•

Apr. 9-10. Conference on Electronics in Industry, sponsored by Professional Group on Industrial Electronics of the Institute of Radio Engineers and Armour Research Foundation of Illinois Institute of Technology. Illinois Tech Commons Building, Chicago.

•

Apr. 10-12. Instrument Society of America. National Nuclear Instrumentation Conference and Third Southeastern Exhibit. Atlanta, Ga.

•

Apr. 11-12. Institute of Radio Engineers. Southwestern Conference and Electronics Show. Shamrock-Hilton Hotel, Houston.

•

Apr. 11. Association of Lift Truck and Portable Elevator Manufacturers. Spring Meeting. Edgewater Beach Hotel, Chicago.

•

Apr. 13. Third Annual College-Industry Conference, "New Processes and Developments in Industry." State University of Iowa, Cedar Rapids.

•

Apr. 14-27. U. S. World Trade Fair. New York Coliseum, New York City.

•

Apr. 15-17. American Society of Lubrication Engineers. 12th Annual Meeting and Exhibit. Sheraton-Cadillac Hotel, Detroit.

•

Apr. 24-25. Second National Industrial Research Conference, sponsored by Armour Research Foundation of Illinois Institute of Technology. Conrad Hilton Hotel, Chicago.

•

Apr. 25-26. Society for the Advancement of Management and American Society of Mechanical Engineers. 12th Annual Management Engineering Conference. Statler Hotel, New York.

. . . Continued on Page 167

Foremen Rousseau and Burns with abrasive engineer Pete Wilson developed a radically new "spec" for these extra-hard metals.

A GRINDING PROGRESS REPORT

Extra Fine Grit Silicon Carbide Succeeds In Tough Vasco Supreme I. D. Grinding Job.

Finer grits and "softer" wheels are the usual approach to grinding hard metals. This was not enough, however, on the hardened die steels required at the W. H. Nichols Co., Waltham, Mass. Wheels soft enough to cut, with the limited pressure of internal grinding, were too soft to hold shape.

Recommended: Silicon Carbide grain, for better penetration into these metals of high carbide content, and grits much finer than the normal 90, to take smaller chips but more of them.

Results: Using 240 grit on the Vasco Supreme, and 150 on the Neatro and Ohio Air Die steels brought about both the quality and quantity of production desired. With wheel dressing reduced to 1/8 the amount formerly required, 50 or more pieces are now completed per wheel.

These results are typical of Bay State. You can get them through your local distributor, any branch office, or the Bay State Abrasive Products Co., Westboro, Massachusetts.

Branch offices are located in Bristol, Conn., Chicago, Ill., Cleveland, Ohio, Detroit, Mich., Pittsburgh, Pa., with distributors in all principal cities.

Slender spindle and large contact area limit infeed pressure, making wheel selection critical on hard, abrasion resistant metals.

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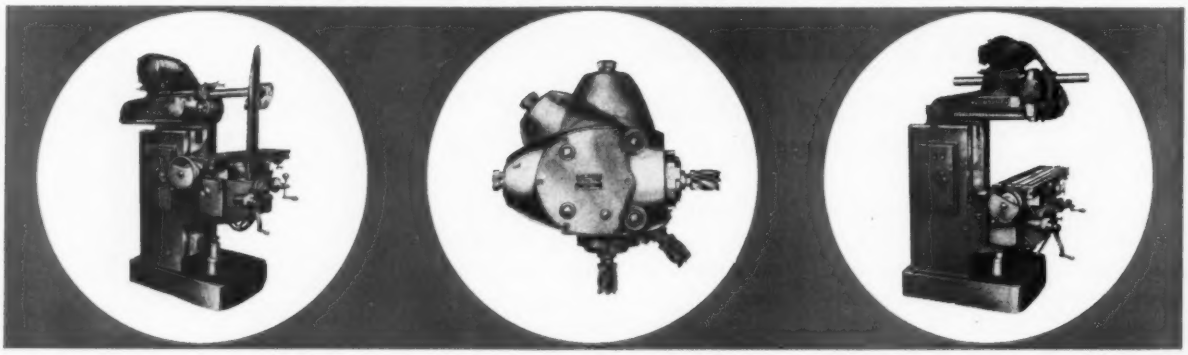
WHEELS of PROGRESS

CIRCLE INFORM-A-GRAM KEY NO. 165

Why buy 2 when ONE will do... when it's a VAN NORMAN Ram type miller

No. 16S — The most versatile miller available — features the quill type adjustable cutterhead that permits horizontal, angular and vertical milling plus boring and drilling. Table: 40½" x 10"; Quill Travel: 4"; Quill Power Feeds: .0015; .003; .006; Cutterhead Spindle Motor: 2 HP; Speeds: 110 to 3600.

A single investment in ONE Van Norman ram type miller gives you the equivalent of two single purpose machines plus attachments. And at a much lower cost.



No. 16M — a heavy duty miller designed for maximum rigidity and accuracy. Table: 40½" x 10"; Ram Travel: 20½"; 3 HP Cutterhead Spindle Motor; Speeds: 50 to 2000.

This adjustable cutterhead, on the Van Norman 16L & 16M, gives you two millers in one. It enables you to do horizontal, angular or vertical milling, minimizes work reset-ups, cuts idle machine time and tooling costs.

No. 16L — designed to increase production and cut costs in toolrooms, machine shops, pattern shops and on production lines. Table: 40½" x 10"; Ram Travel: 20½"; Cutterhead Motor: 2 HP; Speeds 84 to 2760.

Get complete details on the Van Norman 16S, 16L, and 16M today. Write, wire or telephone for catalog.

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Don't wait . . . for extra profit install a Van Norman machine now! They are available on several purchase plans . . . Outright sale . . . On conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

. . . Coming Events from Page 164

Apr. 25-26. American Zinc Institute. 39th Annual Meeting. Drake Hotel, Chicago.

•

Apr. 25-26. Institute of Environmental Engineers. First Annual Technical Meeting and Equipment Conference. LaSalle Hotel, Chicago.

•

Apr. 25-30. Metal Powder Association. Annual Meeting. Drake Hotel, Chicago.

•

Apr. 29-30. Association of Iron & Steel Engineers. Spring Conference. Hilton-Plaza Hotel, Cincinnati.

•

Apr. 29-May 3. American Material Handling Society. Seventh National Material Handling Exposition and Conference. Convention Hall, Philadelphia.

•

May 1-3. American Institute of Electrical Engineers, Institute of Radio Engineers, Radio-Electronics-Television Manufacturers Association and West Coast Electronic Manufacturers Association. Electronic Components Symposium. Morrison Hotel, Chicago.

•

May 3. Fourth Annual Conference for Engineers and Architects. College of Engineering. Columbus. Ohio State University.

•

May 7-12. National Association of Architectural Metal Manufacturers. 19th Annual Convention. Fairmont Hotel, San Francisco.

•

May 8-11. Fluid Control Institute, Inc. Meeting. Greenbriar, White Sulphur Springs, W. Va.

•

May 20-23. American Society of Mechanical Engineers. Design Conference and Design Engineering Show. New York Coliseum.

•

May 22-24. American Society for Quality Control. 11th Annual Convention. Masonic Temple, Detroit.

•

May 23-24. Society for the Advancement of Management. Small Business Conference. Hotel Statler, New York City.

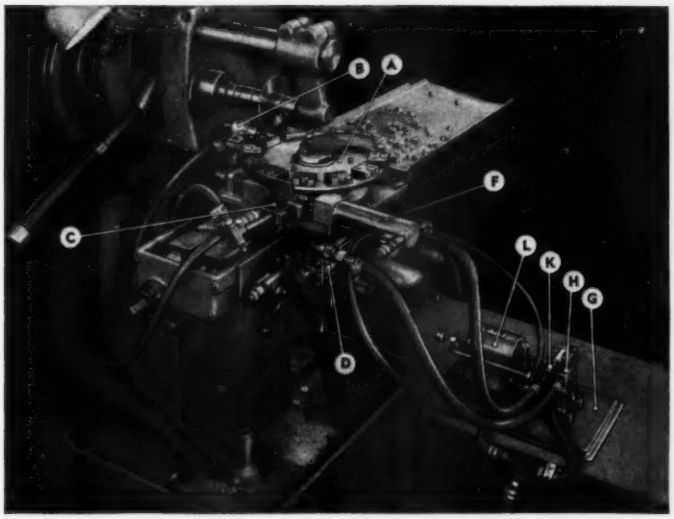
NECROLOGY

Harry W. Barkley, 52, president and general manager of The National Tool Company, Cleveland, died in February. Prior to his association with National Tool, he served for 27 years in various executive capacities with Ford Motor Company.

Hans Wickstrom, 86, retired sales representative for Norton Company's Grinding Machine Division, died at his Worcester, Mass., home February 13.

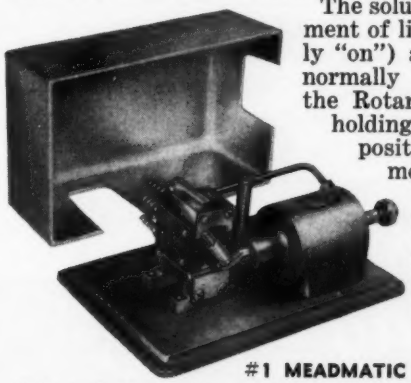
Marcel F. Bachner, 65, president and treasurer of the Chicago Molded Products Corp., died in February of a heart attack.

Automation with Air Power



Five standard Mead units converted this hand milling machine into a semi-automatic machine to mill a slot in threaded brass valve plugs, increasing the production from about 375 per hour to more than 1200.

The mill table is moved forward and back by an air cylinder with 1½" bore and 5" stroke, and during each cycle the Rotary Table discards the finished part and indexes a new part to the work station. The Meadmatic Timer is the "brains" of this hookup, delivering air at the right instant to the feed cylinder (D) and consequently to the Rotary Table, (A) and the work-holding cylinder (B). The problem was how to synchronize the motions so that the dial of the rotary table would not rotate while the work was passing under the cutter.



The solution was in the arrangement of limit valve (F), (normally "on") and auxiliary valve (C) normally "off", which keep both the Rotary Table and the work holding valve (B) in the locked position while the mill table moves forward and back; but when the mill table returns to its starting point (A) and (B) are momentarily released to index to the next station.

#1 MEADMATIC TIMER

Write to Factory or Nearest Mead Representative for Bulletin HA-47

See Alphabetical index Thomas' Register for nearest Mead Man Address or Phone Number.

MEAD

SPECIALTIES COMPANY

4114 N. Knox Ave., Dept. HA-47, Chicago 41, Illinois

Pathfinder in AIR POWER AUTOMATION

CIRCLE INFORM-A-GRAM KEY NO. 167

LAYCO

METAL STAMPINGS

This question is in everyone's mind these days. Idle press time can eat up money so fast that it is forcing people to take a second look into their stamping operations. Many are finding that it's just too darned expensive to maintain their own stamping departments, even the largest ones. Frequently, it is less expensive in the long run to turn to specialists like Laystrom. We have the right press to fit each job, giving you maximum production at the lowest cost — consistent, of course, with Laystrom's traditionally high quality for stamping work.

A close look at "make or buy" is vital these days. If your decision is "Buy," you will do well to contact Laystrom. We have helped many people cut costs. Perhaps we can help you too.

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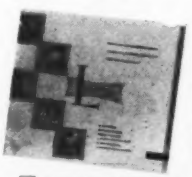


☐ We are sending drawings for quotation. ☐ Have salesman call. ☐ Send brochure only.

CIRCLE INFORM-A-GRAM KEY NO. 168

GROWING PAINS

A $600,000 expansion program for this year has been announced by **Putnam Tool Company.** Included in the program are a major addition to the plant, new manufacturing facilities, and equipment.

Controls Company of America will increase the assembly and fabrication operations at the Nijmegen, Holland, plant of its subsidiary, Controls Maatschappij Europa N.V. Now being built is a 7,000 sq ft addition to increase working space to 25,000 sq ft. In addition, the company has acquired more than 55,000 sq ft of adjacent land for future expansion.

A modern manufacturing plant, which will increase the investment casting capacity of **Austenal, Inc.,** is now under construction at LaPorte, Ind. This new facility, which will be completed by September 1, will be the third production unit established by the company. Many new applications for the Austenal vacuum investment casting process are being found in industries where high-temperature, high-stress alloys are required.

To permit rearrangement of production operations and to increase output, **Sherman Products, Inc.** has added about 30% more floor space to its plant and offices in Royal Oak, Mich.

Northeast Metals Industries, Inc. has acquired a 26,000 sq ft building in Philadelphia. The company, a leading supplier of fabricated sheet metal products to electronics and aircraft industries, expects to triple output when the new plant is put into production.

Clark Equipment Company has disclosed that it is building a 300,000 sq ft facility in Chicago and expanding its Construction Machinery Division plant in Benton Harbor, Mich., by 63,000 sq ft. Both will be completed in June.

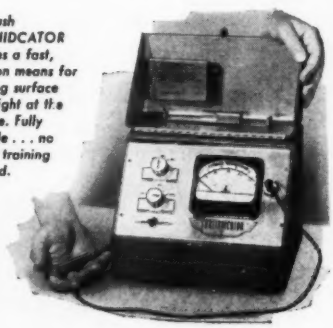
Smooth-On Manufacturing Company has announced that construction now underway at the Jersey City, N. J., plant will more than double present plastic research facilities.

A new stainless steel plant will be built near Coshocton, Ohio, by **Universal-Cyclops Steel Corporation.** A 30" wide stainless cold reduction mill with all the necessary auxiliary finishing facilities will be installed in this plant. This equipment is designed to produce wider strip than is now possible on the company's present mills.

How much profit is machined out of your product?

Whenever your product is finished one micro-inch more than specified, profit is actually machined away. In the past, this waste was due to the machinist's inability to accurately judge how far he had progressed in his surface finishing operations.

This situation need not exist today. Brush has developed a remarkable new tool, the Brush SURFINDICATOR*, that can be used by anyone to accurately measure surface finish on metal, paper, wood, plastic—*any* material.



The Brush SURFINIDCATOR provides a fast, precision means for checking surface finish right at the machine. Fully portable . . . no special training required.

Here's how profit can be protected

The SURFINDICATOR measures surface finish to within one micro-inch providing a direct reading in accordance with new industrial and military standards. A hand-held stylus is simply stroked over the surface to be measured and the reading taken—no special training is required. The entire SURFINDICATOR is completely portable and permits the machine operator to finish a surface to exact specifications—no more, no less—no wasted machine time, no rejects.

And, to permit accurate re-calibration in the field, precision reference specimens are supplied with every instrument. These specimens, exclusive with Brush, are the ASA approved precision reference standards for surface finish measurement.

SURFINDICATOR booklet contains new ASA standards and complete details on cost-saving finish measurement . . . New Surface Finish Control Efficiency Study can be made on your production line.

The complete story on how the SURFINDICATOR prevents overfinishing, protects your profits, can be obtained on request. A Surface Finish Control Efficiency Study form is also available to aid in evaluating finishing cost efficiency in your plant. Write for both the SURFINDICATOR booklet and the Efficiency Study form today. *T. M.

BRUSH ELECTRONICS COMPANY

3508 Perkins Avenue, Cleveland 14, Ohio

BRUSH 6 ELECTRONICS

DIVISION OF CLEVITE CORPORATION

CIRCLE INFORM-A-GRAM KEY NO. 169

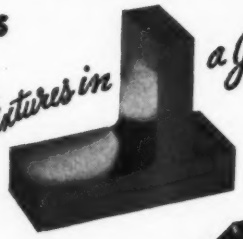
NOBLE & STANTON *Standards* FINEST QUALITY

JIG and FIXTURE COMPONENTS

Complete Line—Over 500 Parts

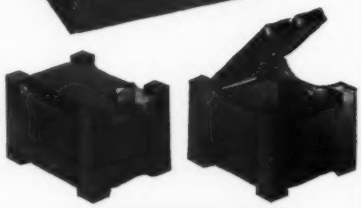
"T" ANGLE PLATES

Fixtures in a Jiffy!



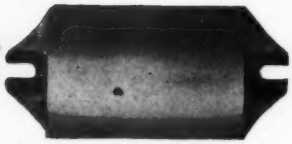
Our "T" Angle Plates have many applications as milling fixtures, comparator stands or drill jigs. The addition of a few special parts make this a complete fixture at little cost. Normalized and precision machine castings. Full scale sheets of 7 standard sizes will be included with your catalog if requested.

BOX JIGS



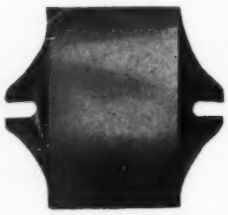
Box Jigs shown are made in either square or rectangular style in 9 sizes. Have them on hand in several sizes, use them, and watch your profits mount.

MILL FIXTURE BASES



The Mill Fixture Base shown on top is available in four sizes, the Gang Mill Fixture Base in three. Both are furnished with either standard keyways or jig-bored holes for "Sure-Lock" Fixture Keys at no extra cost. These normalized bases are precision ground, parallel top and bottom with one side finished parallel to the keyways, eliminating the delay and expense necessary in obtaining patterns, castings, normalizing and machining. Ask for full scale template drawings in your size range.

Sure Lock Fixture Keys See Page 41 of our Template Catalog



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NEW ITEMS

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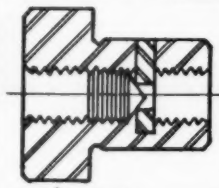

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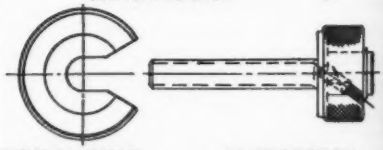

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APRIL 1957 ISSUE

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3	23	45	64	123	140	160	210	251	1703	1843	1903	2042	2161	2275	2361	2471
4	24	46	65	125	160	171	213	282	1704	1844	1904	2043	2162	2276	2362	2472
5	25	47	66	127	161	170	214	1701	1771	1845	1901	2111	2163	2281	2363	2473
6	27	48	67	129	163	181	217	1702	1772	1881	1902	2112	2201	2282	2364	2474
7	28	49	68	131	164	182	218	1703	1773	1882	1903	2113	2202	2283	2381	2481
8	29	50	69	132	165	185	221	1721	1781	1883	1904	2121	2203	2284	2382	2482
9	31	51	70	133	166	187	222	1722	1782	1901	1981	2122	2204	2311	2383	2483
11	32	52	72	134	167	189	225	1731	1783	1902	1982	2123	2231	2312	2384	2484
12	33	53	105	135	168	191	226	1732	1784	1903	1983	2124	2232	2313	2401	2485
13	34	54	107	137	169	193	229	1741	1801	1904	2001	2161	2233	2321	2402	2491
14	35	55	108	139	161	194	230	1742	1802	1905	2002	2162	2234	2322	2431	2502
15	36	57	111	139	162	197	233	1743	1803	1921	2003	2163	2241	2323	2432	
16	37	58	112	141	163	198	234	1744	1804	1922	2004	2161	2242	2324	2433	
17	38	59	115	143	164	201	237	1781	1831	1923	2081	2162	2243	2381	2434	
18	39	60	116	145	165	202	238	1782	1832	1924	2082	2163	2271	2382	2435	
19	41	61	117	146	166	205	241	1783	1833	1925	2083	2164	2272	2383	2441	
21	43	62	118	147	167	206	242	1781	1841	1951	2084	2165	2273	2384	2442	

EDITORIAL ITEMS

A1	A19	A37	A55	A73	B3	B21	B39	B57	C9
A2	A20	A38	A56	A74	B4	B22	B40	B58	C4
A3	A21	A39	A57	A75	B5	B23	B41	B59	C5
A4	A22	A40	A58	A76	B6	B24	B42	B60	C6
A5	A23	A41	A59	A77	B7	B25	B43	B61	C7
A6	A24	A42	A60	A78	B8	B26	B44	B62	C8
A7	A25	A43	A61	A79	B9	B27	B45	B63	D1
A8	A26	A44	A62	A80	B10	B28	B46	B64	F1
A9	A27	A45	A63	A81	B11	B29	B47	B65	F2
A10	A28	A46	A64	A82	B12	B30	B48	B66	F3
A11	A29	A47	A65	A83	B13	B31	B49	B67	F4
A12	A30	A48	A66	A84	B14	B32	B50	B68	F5
A13	A31	A49	A67	A85	B15	B33	B51	B69	F6
A14	A32	A50	A68	A86	B16	B34	B52	B70	F7
A15	A33	A51	A69	A87	B17	B35	B53	B71	F8
A16	A34	A52	A70	A88	B18	B36	B54	B72	F9
A17	A35	A53	A71	B1	B19	B37	B55	C1	F10
A18	A36	A54	A72	B2	B20	B38	B56	C2	

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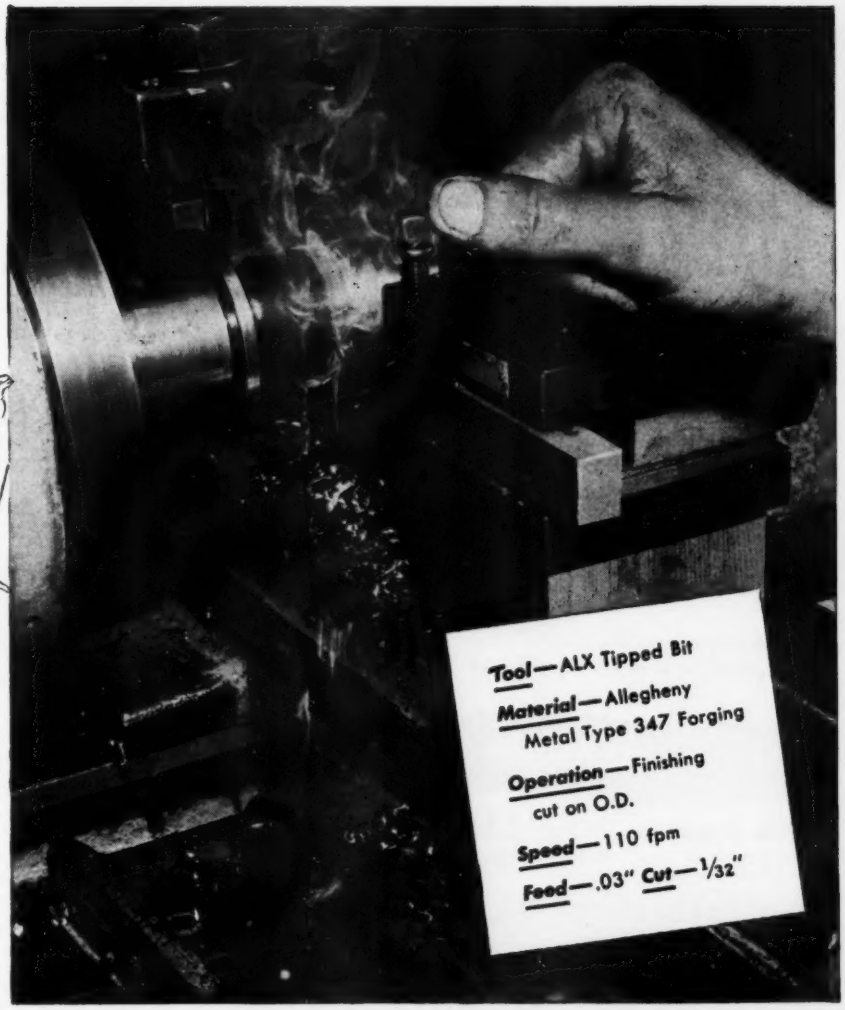


. . . then get ALX ALLOY Cutting Tools

Write for copy of

"ALX ALLOY TOOL BITS"

This new bulletin, just off the press, tells how you can effect production economies by using ALX for fast turning, boring, and facing operations in certain applications. Helpful information on analysis, properties and applications—includes grinding, tool angles, speeds and feeds, brazing of tips. *Write for your copy.*

ADDRESS DEPT. TP-88

Many a machine shop—and probably yours—has jobs on which ALX Tipped Tools or ALX Solid Bits step up production by permitting increased speeds, feeds, and depths of cut. Resharpening is less frequent, the reason being special composition.

ALX is a cast-to-shape, non-ferrous, cobalt-base alloy containing chromium, tungsten, carbon, and boron. The as-cast hardness of 60-62 Rockwell C obviates later heat treatment. Tools stay sharp at accelerated speeds and higher temperatures. Speed range is above that of high-speed steel, but lower than with carbide. At such intermediate speeds, the superior performance of ALX results from toughness, red-hardness, edge-strength, and abrasion-resistance values combined.

An Allegheny Ludlum tool engineer can quickly point out the strategic spots to tool up with ALX. For this service, call A-L. ● *Allegheny Ludlum Steel Corp., Forging & Casting Division, Wanda & Jarvis Aves., Detroit 20, Mich.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

W&D 5441

AL
FINE TOOL STEELS
SINCE 1854

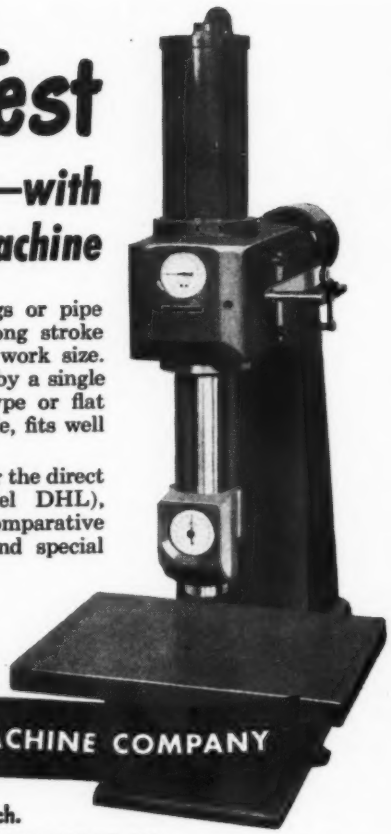
CIRCLE INFORM-A-GRAM KEY NO. 171

Brinell Test

large pieces fast—with this long stroke machine

Large awkward castings, forgings or pipe are easily tested because the long stroke eliminates screw adjustment to work size. The hydraulic ram is controlled by a single lever. Large, stationary roller-type or flat table makes work handling simple, fits well into a conveyor line.

Choice of plain Brinell machine or the direct reading machine (shown, model DHL), where dial at end of ram gives comparative hardness immediately. Larger and special machines may also be had.



Write for more information on all our Brinell testing machines.

DETROIT TESTING MACHINE COMPANY

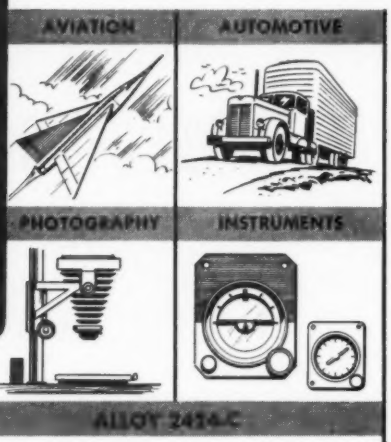
9386 Grinnell Ave., Detroit 13, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1721

the growing trend in tooling

RED METALS CO. SEAL

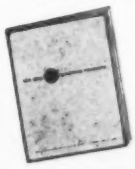
ALUMINUM TOOLING PLATE



ALLOY 2424-C

Alloy 2424-C is Red Seal's new designation for their aluminum tooling plate and bar stock. The new designation is to help you better understand material composition. The "C" indicates material is cast.

COMPARE...No matter what material you are presently using for tools and fixtures, Red Seal's Alloy 2424-C will give you better performance, lower costs, and increased production.



INVESTIGATE... Red Seal Aluminum Alloy 2424-C for your tooling requirements. Call or write for this new Red Seal Aluminum Products catalog today.

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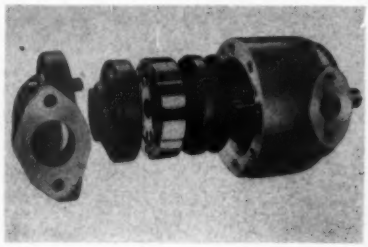
CIRCLE INFORM-A-GRAM KEY NO. 1722

NEW PUMP SUPPLIES 2000 PSI SERVICE

A new series of balanced vane hydraulic pumps for continuous 2000 psi service has been developed. "T" Series pumps will supply rated deliveries of up to 100 gal/min at speeds up to 1800 rpm.

They are available with either clockwise or counter-clockwise shaft rotation, which is easily changed by indexing the cam ring to the dowel pin hole with the arrow indicating the desired direction of rotation.

The pump consists of a housing which provides an outlet connection, a bore for support of the shaft bearing and shaft assembly, and a larger bore which contains the floating pumping cartridge. By providing maximum shaft support, the bearings permit use in applications with higher shaft side loading.



"T" Series pumps can be face, foot or flange mounted in any of four positions on the mounting bracket. The suction inlet port can be assembled in many selected positions with regard to the pressure delivery port.

Pumps of this series are used for special machinery and automation. They are particularly applicable where 2000 psi hydraulic pumps mean lower weight and increased payload.

Their advantages include continuous efficient life, simple to adapt since the pump can be mounted in any of four different positions, trouble-free starting, rotation in either direction and simplicity of service.

American Brake Shoe Co., Denison Engineering Div'n, 1160 Dublin Rd., Columbus 16, O., will supply details on "T" Series vane hydraulic pumps, or—**Circle Inform-A-Gram No. D1.**

A fully equipped metallurgical laboratory has been added to the facilities of Alloy Steels, Inc., with offices and warehouse located in Detroit. It provides a complete check on quality specifications and an on-the-spot consulting service for rapid and complete analysis of any metallurgical problems involving tool and alloy steels. Serving as metallurgist in charge of the laboratory is J. E. Carter.

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Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings,

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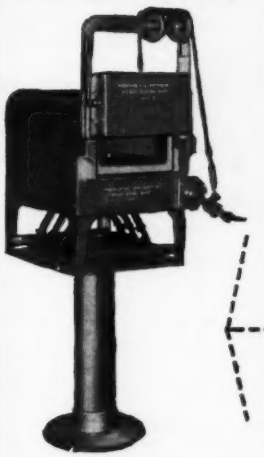

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Bench Model $287.00
No. 654 — smaller version, 4 burners, 5" by 7¾" by 13½" Firebox.
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Six, No. 5 Type A Bunsen Burners give this versatile furnace a 400° to 1800° F. range. Temperatures easily controlled. Ratchet-operated door opens upwards. Use with natural, artificial, mixed or bottled gas. Economical and efficient with all. Firebox 7" by 13" by 16½". 78,000 BTU's per hour. (Natural gas)

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COSTS SO LITTLE

SAVES SO MUCH

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★ **YOU SAVE TIME** with Speed Vise because with a half-turn and a lift of the handle the jaw is free to slide to any desired opening . . . and you have positive locking with the same speed and ease.

★ **YOU SAVE MONEY** with Speed Vise because many interchangeable Speed Vise jigs and fixtures can be made for the price of one old style type box jig.

Write today for complete information and prices.

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FAST • SAFE • BETTER
Material Handling
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400 MODELS

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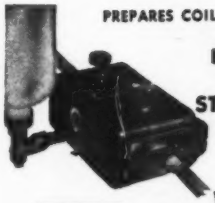

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New Low Cost
LIGHT-DUTY OILER-STRAIGHTENER
$95.00
Handles stock up to 3" wide, 1/16" (app.) thick
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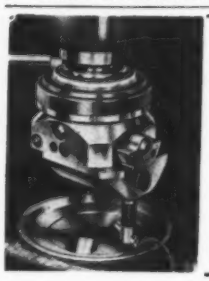

Do you save money with several accuracy jeopardizing set-ups when one set-up could do your work? *We think not!*
BUT . . .
With our WOHLHAUPTER MASTERHEAD IN ONE SET-UP you do boring, facing, recessing, undercutting, turning, etc. on ONE machine and • Save considerable time • Increase production • Increase efficiency • Utilize your present machine park more economically.

9 models of the WOHLHAUPTER MASTERHEAD available with capacities up to 31¼".
All models have automatic feed and automatic end release.
Multiple feed models have 12 slide feeds.
Also Automatic Tapercutting Heads for Angles 0-180°, inside and outside.

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NEISE MODERN TOOLS

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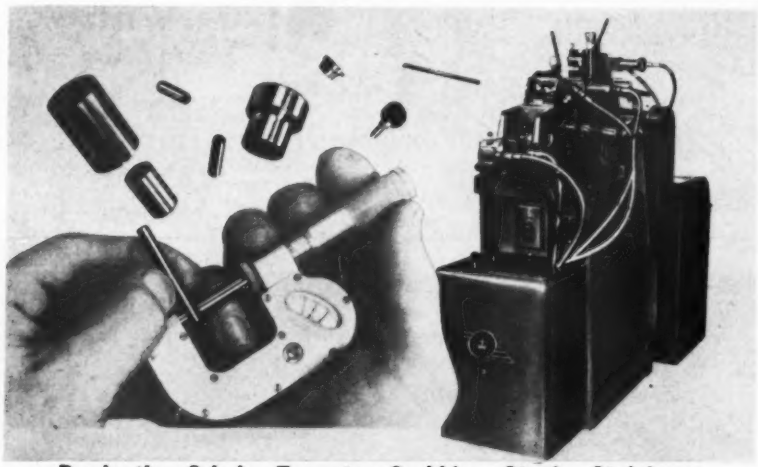

Production Grind - Tungsten Carbide - Steel - Stainless Glass - Plastic or Carbon to .0002 or 6 to 8 Micro finish *

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Apply the versatile Royal Master TG-12 to your grinding problem. It will finish grind from .004 to 1 ½ inches in diameter.

It may be used for either plunge or thrufeed grinding with conversion to either a matter of minutes.

It may be put to work **without** prior spindle warm up time with unparalled accuracy and dependibility - (Based on machines in use for 5 years.)

Low depreciation based on inital cost - Ease and speed of set up time due to accessibility of work zone - Rapid replacement of work wheel and packaged hydraulic system for automatic cycling, are other features of the TG-12. What are your requirements?

* **May we demonstrate the TG-12 for you on your parts?**
Also Grinds Wood, Non-ferrous Metals, Fibre, Hard Rubber, Cork, etc.

☐ Please contact me regarding my "centerless grinding" requirements.
☐ Please forward literature describing the TG-12.

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FIRM .....
STREET .....
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ROYAL MASTER INC. 240 State Hwy. 23, Riverdale, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1744

ELECTRONIC SYSTEM FOR GRINDER GAGING AND WHEEL FEEDING

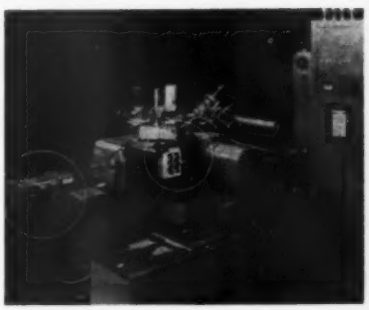
An electronic automatic gage and wheel feed system has been developed for use on through feed centerless grinders producing production parts.

The Kaydon Size-O-Tron, built by The Kaydon Engineering Corporation, Muskegon, Mich., is the result of years of research and practical use for several years in grinding production parts in the Kaydon plant.

The Size-O-Tron utilizes the feedback principle as it automatically gages the parts being ground, automatically adjusts the grinder to compensate for wheel wear and automatically records the size. The finished work is continuously gaged as it emerges from the machine and the information from the gaging unit is fed back to the machine, automatically adjusting all variables that effect size changes.

One operator can run several machines, operating at full speed, and manual gaging is virtually eliminated. On numerous operations where successive passes through three or more grinders were formerly required, at least one machine in the bank can be eliminated.

Scrap loss is usually restricted to set-up pieces, and all parts ground are so much more uniform that further inspection of the parts is not required.



Should the parts being ground deviate more than 10 millionths of an inch from the desired size, the electronic controls detect the trend and start to correct the condition. If some extraordinary condition arises which is beyond the ability of the Size-O-Tron to correct, the automatic controls stop the grinder immediately and a red warning light shows that attention is required.

In actual operation, the Size-O-Tron attached to a conventional centerless grinder is capable of maintaining a tolerance or spread of 0.000050" disregarding the inherent inaccuracies of the machine. If the variation within the machine does not exceed 0.000050", a total tolerance of 0.0001" con be maintained. A practical total tolerance with a well

. . . *Continued on Page 177*

300% Greater Tool Life

has been obtained in one automotive company's crankshaft dept. using

DRILLMATION AUTOMATION TAPMATION

Model 1000 D-H Drilling Machine

12 NECESSARY, *Exclusive* FEATURES IN 1 UNIT

- **DULL TOOL CONTROL** Unit will withdraw tool from work and indicate to operator when tool becomes dull.
- **RAPID TOOL CHANGE** Tool may be replaced without changing the controls.
- **UNIFORM TIME CYCLE** Maintains comparatively constant time cycle even when tools become dull.
- **SELF-CONTAINED HYDRAULIC SYSTEM** Delivers only the oil pressure required to overcome machining resistance.
- **COMPLETELY AUTOMATIC** Enclosed electric controls. Unit is "Fail Safe".
- **THRUST CONTROL** Maximum thrust may be set to protect tools. Will not surge at break point.
- **FEED CONTROL** Infinitely variable and positive feed rate.
- **RAPID APPROACH AND RETURN** Variable irrespective of RPM.
- **MICRO DEPTH CONTROL** Depth will repeat within .0005 inch.
- **EMERGENCY QUILL RETURN** Button on front of unit. Aid in setting tools.
- **COOL OPERATION** Low volume high pressure hydraulic pump used on power stroke only. Air power used for rapid traverse.
- **PRODUCTION MACHINE** Mount in any position. Quiet operation. Self lubricating.

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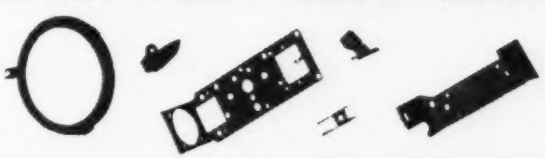
STAMPINGS - - - SHORT RUNS



A dependable service for small quantity requirements for new developments and production up to 50,000 pieces. QUICK DELIVERY — ACCURACY — backed by 25 years' experience.

SMALL LOT STAMPING CO.

Linden 3-3700 "Dedicated to Short Runs" 1025 W. Blancke St. Linden, New Jersey

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Faster Milling . . . at lower cost!

NEWCOMER RC MILLING CUTTERS

using "THROWAY" Carbide Inserts . . . another *"Years Ahead"* development

The new RC Milling Cutter combined with Newcomer "Throway" Carbide Inserts is the answer to higher milling production at lower cost! Mechanically held inserts with proper clearances permit heavier feeds and faster speeds.

Easy to Index!

Patented Super "Jack-Lock" facilitates removing worn cutting edge and reindexing to new cutting edge.

Uses "Throway" Carbide Inserts

Carbide grinding time and costs eliminated. Worn inserts are discarded. Insert stocks are kept to a minimum . . . Bottlenecks in grinding room are eased.

Cutter Inventory Slashed!

One cutter body used to mill both steel or cast iron by using proper grade of Newcomer carbide. Cutter stocks are minimized . . . Fewer cutters necessary as job will no longer have to wait on overtaxed grinding rooms.

Designed for Long Service!

Two piece construction of hardened cutter bodies minimizes replacement cost. Mechanically held carbide inserts cut breakage to a minimum.

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LATROBE, PA.

General Sales Office:
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WITH WOODWORTH CHUCKING EQUIPMENT

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Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.

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Significant savings may result if you let our engineering staff assist you. There is no obligation.

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Rousselle Presses are sold exclusively through leading machinery dealers.

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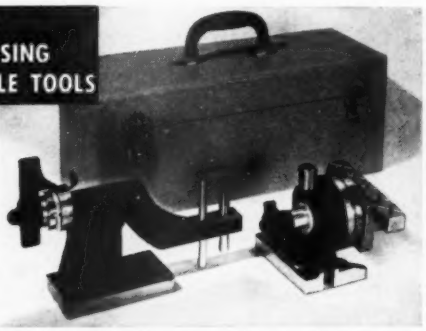
(Both tools including diamonds)

The G-5 RADIUS DRESSER is a precision engineered tool that will dress either a convex or a concave radius from .015" to 1.750" on a 7 inch or 10 inch wheel, and it may be set to the exact radii desired. Graduated stops allow you to dress any desired portion of a radius. The spring tension journal insures chatter free operation. The G-2 ANGLE DRESSER AND TOOL HOLDER is actually two tools in one, having an easy to read vernier scale 0° to 180° giving accuracy within 2" of 1°; an excellent time saver to set up small jobs to be milled, drilled, tapped, etc., on any desired angle.



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. . . System from Page 174

maintained machine on the production line is 0.000150".

A recorder prints a continuous story of the size maintained, also shows shutdowns and thus tells the day's history of the grinder's efficiency.

Kaydon developed this Size-O-Tron to assist in grinding billions of needle rollers which Kaydon produces for use in automatic transmission, universal joints, steering gears and clutches for the automotive industry.

SINGLE PROBE CONTROLS MULTIPLE TRACER MOVEMENTS

Development work on a new line of electronic hydraulic tracer control machines, performed in conjunction with Pegasus Laboratories, has been completed by Tracer Control Company, 595 E. Ten Mile Rd., Hazel Park, Mich.

Successful field demonstrations under actual production conditions have been made to airframe manufacturers and machine tool builders. An important feature of the new three-feed Duplimatic is that it accomplishes plane and depth control with a single probe.

Good surface finish with accuracy in tracing has been possible with Tracer Control's standard line of Duplimatics for several years, but the high feeds — up to 100"/min — required in airframe and other high speed machining, can now be offered for the first time. The only limit of speed now lies in the natural frequency of the machine tool itself, as the response-stiffness of the new electric-hydraulic system is far in excess of present machine tool design.

The new "E-Series" allows tracing within ful range of the machine tool. Conventional operation of the machine tool is not restricted. Unimpeded use of all conventional controls is accomplished after installation by automatic push button interchange.

The new tracer control equipment can be supplied as original equipment on machine tools or be installed on existing machines in the field. The natural frequency of the machine tool, new or old, can be predetermined and tracer performance predicted prior to installation.

You can obtain your copy of Metlfax Magazine by writing to Dan Daniels, Metlfax Magazine, 1975 Lee Road, Cleveland 18, Ohio.

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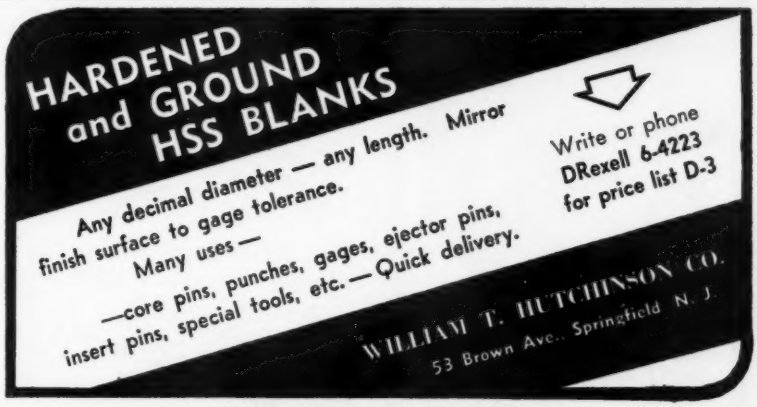
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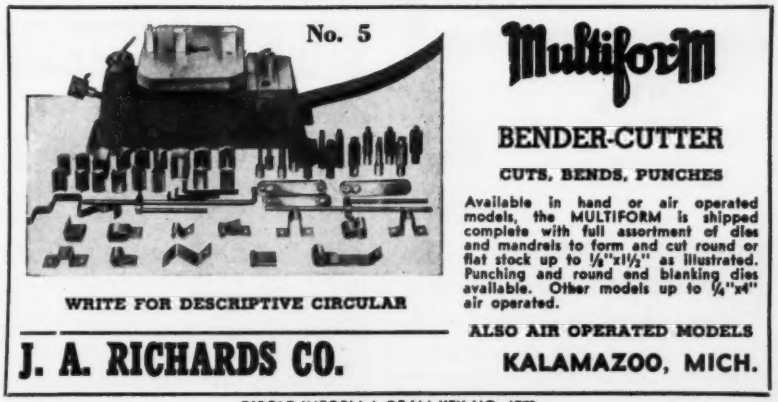
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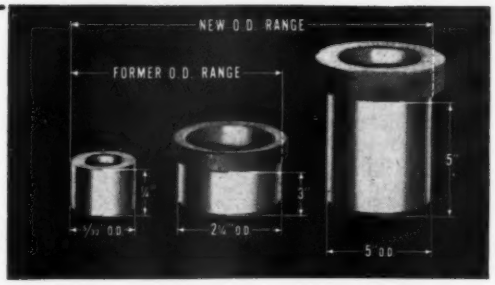

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CIRCLE INFORM-A-GRAM KEY NO. 1784

Frank J. Rossmann has been appointed assistant to the vice president, Field Sales Division, Giddings & Lewis Machine Tool Co. He will undertake special sales assignments covering the product applications of all Giddings & Lewis divisions. His headquarters will be in Cincinnati, O.

George W. Stamm is the new general manager of sales for Crucible Steel Co. of America. He is located at company headquarters in Pittsburgh. **Felix Kremp** has been named assistant product manager-high speed tool steel sales and **E. E. Lull,** assistant product manager-tool steel sales.

John H. Locke, Jr. has been promoted to eastern district manager for John Bath & Co., Inc., with headquarters in Philadelphia. He is succeeded as sales engineer at the Philadelphia office by **Thomas P. Tucker.**

The appointment of **Ervin J. Baumrucker** as general sales manager of Clearing Machine Corp., division of U. S. Industries, Inc., has been disclosed. **George Herrick** has become sales manager for the Detroit area.

William E. Burns is serving as sales and engineering representative in southern California for Michigan Tool Co., headquartering in Downey, Calif. The sales and engineering representative in the Pittsburgh area is **Robert C. McCartney.**

William J. Martin has become district manager for Michigan Abrasive Co. in the Cleveland-Columbus-Pittsburgh area.

The promotion of **Wesson C. Miller** to sales manager has been announced by The Parker-Hartford Corp.

Norton Co. has appointed three new abrasive engineers and reassigned a fourth. **Bruno D. Hendrickson** who has been an abrasive engineer since 1954, will cover the part of western New York in the Buffalo area. **Robert T. Haigh** will serve in part of the western New York area with headquarters in Rochester; **Charles R. Garfield,** northwest Pennsylvania; and **David L. Lloyd-Rees,** a territory consisting of Pittsburgh and southwestern Pennsylvania.

Malcolm Onwood has joined the eastern staff of Chicago-Latrobe Twist Drill Works covering the central Connecticut territory. **Paul Rangel** is operating out of the Los Angeles branch with several other field men who serve the southern California territory.

David M. Gaskill is serving as manager of industrial equipment sales for Brush Electronics Co., division of Clevite Corp.

George A. Viscomi has moved into the position of sales manager for the Manufacturing Division of The Lees-Bradner Co. He will be responsible for the marketing of the company's gear hobbers, spline hobbers, and thread millers.

The new direct sales representative for Hy-Pro Tool Co. is **Jack Merritt.** He will operate out of the Detroit office, covering Michigan.

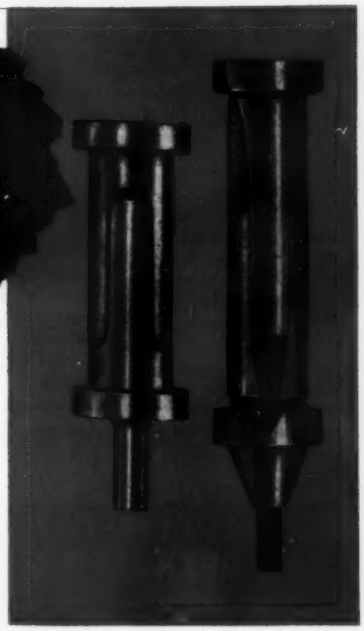
Putnam Tool Co. has named **Melvin L. Weinberg** as vice president in charge of sales and service.

Peter Flesch is the new sales representative in the New York City and Long Island areas for Empire Tool Co.

Sven E. Widen has taken over as assistant sales manager for The Atrax Co. His primary duties will be sales liaison with over 80 manufacturer's agents in the United States, Canada and foreign sales channels.

Ex-Cell-O Corp. has named **Jack L. Mustard** as sales manager, Industrial Division.

The Ability to Serve Many Needs...



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Durable Perforators, Vertically Lapped, and Electrocoted, strip easier, eliminate galling and REDUCE PRESS DOWNTIME.

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Two decades of punching know-how assures you practical answers to your perforating problems. Ask for our new Durable Catalogue, and Engineers Handbook. It's FREE.

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CIRCLE INFORM-A-GRAM KEY NO. 179

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f.o.b. Chicago

This "one man" die handler belongs in every machine shop

GREATER LIFTING RANGE

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Roller bearings in wheels and casters for easy moving. Floor lock included.

High and low speed crank studs at each end of table.

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CIRCLE INFORM-A-GRAM KEY NO. 1801

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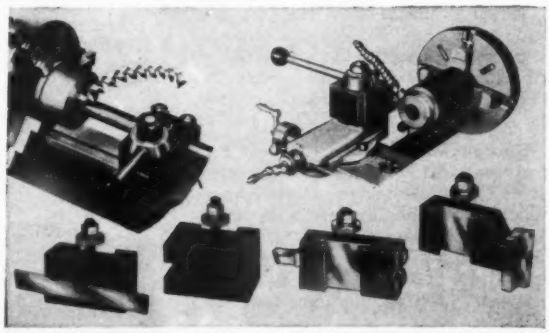
Speed Your Operation .... Save You Money



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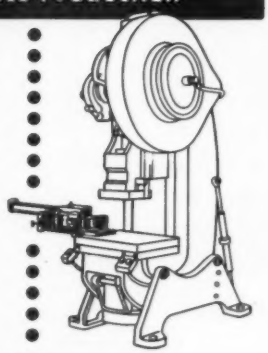
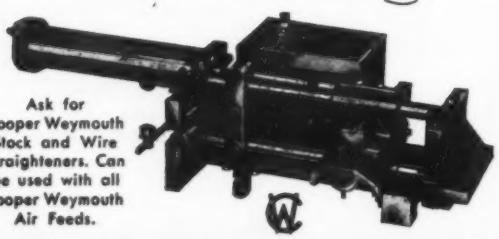
Boost Power Press Production

Specifically designed to solve the automatic feeding problems in press rooms. Simplified, open throat construction. Air operated from standard shop lines. Easily set up and adjusted at the front, rear or sides of press for accurate long or short runs. Cooper Weymouth Air Feeds, made in five sizes, will feed lengths up to 36", of stock up to 18" in width. They are readily adaptable to material of irregular cross section and ideal for use with hydraulic presses.





Ask for Cooper Weymouth Stock and Wire Straighteners. Can be used with all Cooper Weymouth Air Feeds.

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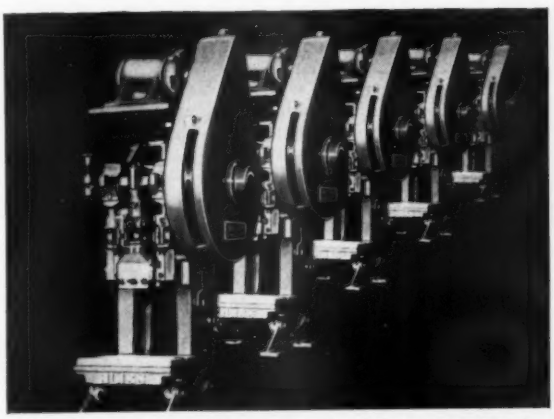

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San Jose, California

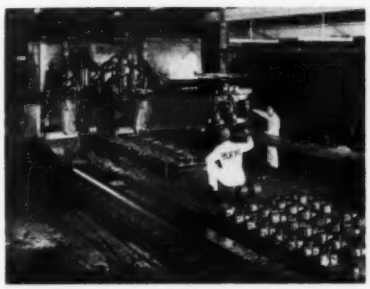
CIRCLE INFORM-A-GRAM KEY NO. 1804

TRACER CONTROL DIRECTS VERSATILE MILLING MACHINE

Boeing Airplane Company, Wichita, Kans., is now using two new 85-ton contour profile milling machines equipped with General Electric electric tracer control systems in its production of B-52 global bombers for the U. S. Air Force.

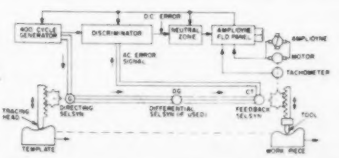
Boeing's application of the General Electric tracer controls has made possible stepped-up parts production, greater precision, and a reduction in the number of machines needed. Actual production figures are classified but Boeing officials report that the machines quickly cleared away a six-week backlog of work immediately after their installation and have not been behind schedule since the third week of operation.

The contour profile milling machines, manufactured by the Onsrud Machine Works, are used by Boeing in processing spar and wing chords and wing skins requiring a wide variety of machine cuts. Many of the necessary cuts require rise and fall, transverse, and twist motions simultaneously. For this reason, the milling machines are normally set up with multi-purpose tooling fixtures which allow almost complete machining of a single part before it leaves the machine.



Profile milling machine in operation at Boeing Airplane Company. Machine is directed by electronic tracer control.

The multitude of operations performed by the Onsrud machine are directed by the G-E tracer control which operates from lineal cams or templates mounted parallel to the working surface and located near the base of the machine. Templates need be no more than ⅛" thick. In operation, the cutting tool is guided over the workpiece by tracer heads which automatically follow the contours of full-size master templates and control the speed of the feed drives. Duplicate parts, including those that are too complicated for a machinist to make even at very slow speeds, are turned out accurately and economically, according to Boeing and G-E engineers.



This block diagram represents the selsyn tracer control equipment necessary to control one feed motion — there are 12 feed motions.

The G-E tracer control system includes six one-dimension tracers capable of controlling three motions on each of two heads simultaneously. Rise and fall and twist motions use selsyn-type tracers which have greatly reduced machine complexity and simplified the making of templates.

Boeing equipment engineers report that materials being machined on the contour profile milling machines range in size from extruded sections

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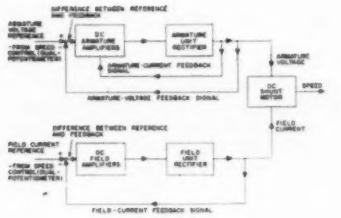
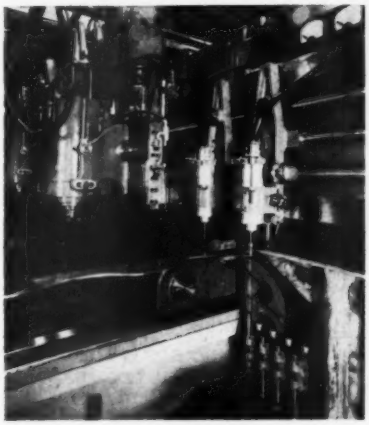


In addition to the 12 selsyn-controlled feed motions, there is one 5 hp Thymotrol drive used for the independent carriage feed motion as represented by this block diagram.

of approximately 13" in width by 12' in length to wing skin sections measuring approximately 7' x 25'.

Tests made on these machines at the Onsrud plant prior to installation consisted of repeat cut operations, depth of cut capabilities, and general performance tests. Repetitive accuracies were found to be from 0.002" to 0.003". In addition, a ¾" depth of cut 7" wide on rise and fall with changing transverse and twist motions was performed. After production was underway at the Boeing plant, it was found that the machines were even more accurate providing repeat cuts of accuracies to 0.002". These accuracies were achieved at production rates as high as 30"/min.



Closeup of four Onsrud tracing heads using General Electric selsyns for control of rise and fall and twist motions also two tracing heads for horizontal control.

WHAM and there goes spindle accuracy

Our illustrated "character" is about to ruin spindle accuracy with a hammer and drift key that cost a lot of money to get in the first place. Modern P.D.Q. tooling can eliminate this abuse ..and save time and money as well. A quick one-sixth turn of the holder nut releases the adapter and you're ready for the next operation... it's as easy as that. How about those machine tools in *your* plant? Get the facts on P.D.Q. tooling... Write fc complete information.

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PDQ PORTAGE Double-Quick, Inc.

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INERT ATMOSPHERE PILOT PLANT FOR MOLYBDENUM TESTS

The unique inert atmosphere pilot plant for fabricating molybdenum metal at Universal-Cyclops Steel Corporation's research and development center should be in operation by the end of this year.

It is unique because it will make possible the fabrication of molybdenum and other refractory metals in a completely enclosed room under an inert gas atmosphere and at a temperature ranging from 3500° F to 4000° F.

Fabrication of molybdenum alloys with conventional steel mill equipment or at conventional temperatures has always been a problem because the metal melts at a temperature above 4700° F. The metal has high temperature strength at most temperatures, however, whereas most other metals become weak.

In the pilot plant room, molybdenum ingots will be heated and formed into forged and rolled products. The room will have three air locks — one for equipment, one for supplies and one for personnel. In addition, some machining and fabricating equipment will be inside for testing to determine the feasibility of working in an inert atmosphere,

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Investment Casting Cost: **$1.48 EACH IN 1000 LOTS**

Complete Stamped Assembly Cost: **43¢ EACH IN 1000 LOTS**

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DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7B, MINN.

CIRCLE INFORM-A-GRAM KEY NO. 1831

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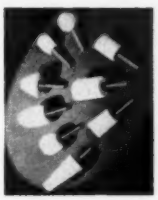

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Paramount Felt Bobs make ultra-fine finishing of surfaces quick, easy and economical.

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Thousands of die and mold makers depend on Paramount Bobs to perform precision finishing and buffing operations. Ideal for removing burrs without destroying close tolerances.

NEW BOB ASSORTMENT KITS

K-1 Assortment includes 24 mandrel mounted bobs, 36 small wheels, touch-up pads — 66 pieces all together — packaged in one convenient bench top box. (K-2 Assortment also includes four sticks assorted polishing compounds.)

These handy assortments provide bobs of just the size, shape and hardness you want — and at $10.95 (K-1) and $12.95 (K-2) they are far below the cost of buying bobs separately.

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Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

The RPM's stay up while grinding . . . not only when the grinder runs idle. That means better work—longer wheel life.

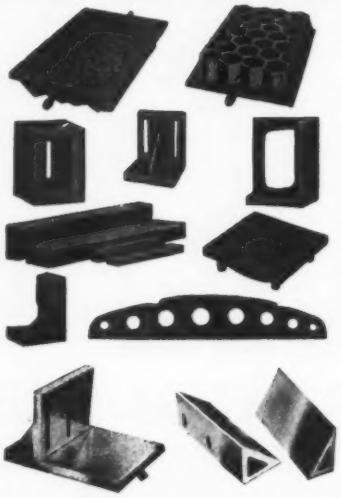
High speed grinding with small wheels was a Madison-Kipp development of the late twenties. It was born out of a pressing need in our tool room. Because tool room grinding problems are universal, we believe it will pay you to utilize Kipp grinders in your tool room as generally as we do in our own.

kipp

MADISON-KIPP CORP.

212 Waubesa St. • Madison 10, Wis., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 1833



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Measuring Irons
Masterangle Plates
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ACME TOOL COMPANY
75 W. Broadway, New York 7, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1841

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Milne's large orders come in three sizes—small, medium and large. Across the continent, Milne has 40 saws cutting tool steel to your order, whether it's in pounds or tons.

And wherever you are, a Milne man is near you. There are 38 Milne tool steel specialists strategically placed to help you with tool steel problems and expedite your order.

Big or little, your order gets the maximum in Milne service.

Wide range of sizes and grades in WATER HARDENING—NON-DEFORMING—SHOCK-RESISTING—HOT WORK AND HIGH SPEED TOOL STEELS

All full length Kolorkoted for permanent identification

Write or call for Milne's Tool Steel Selector.

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CIRCLE INFORM-A-GRAM KEY NO. 1844

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See your dealer or write for catalogue 788 on the most complete line of magnetic base units & access. mfg'd.

CULLEN MFG. CO., RACINE, WIS.

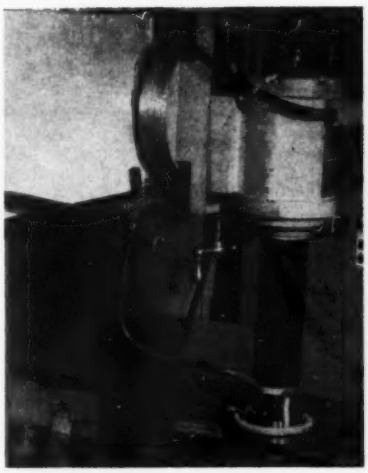
CIRCLE INFORM-A-GRAM KEY NO. 1845

ELECTROLYTIC METAL REMOVAL

Grinding stainless steel aircraft honeycomb surfaces is an application for the electrolytic metal removal method.

The installation view shows The Standard Electrical Tool Co.'s No. 2759Y super precision spindle with No. 1D feed and 360° graduated swivel mounting base set up on the rail of a planer, and a honeycomb plate positioned on the planer bed.

The motorized grinding spindle is powered by a 5-hp motor at 3600 rpm and accommodates a 6" dia metal plate wheel impregnated with abrasive or diamond particles.



Electrolytic metal removal involves the assembly of a (brush) slip ring on the back of the spindle for carrying the direct current through the spindle to the wheel, the wheel acting as the (cathode) negative pull, while the workpiece represents the (anode) positive pull. Assembled on the wheel end of the spindle is a sprinkler-spider of circular design with hose connection for spraying the electrolytic solution at the perimeter of the wheel. The wheel holder has an integral circular well with tangent holes arranged to carry the electrolytic solution in the wheel recess, both delivering a flooding of the work area.

The direct current necessary for electrolytic metal removal passing through the spindle is completely isolated with an individual design developed by Standard Electrical Tool. This isolation feature eliminates pitting of ball bearings and assures efficiency and longevity of ball bearing performance. This isolation barrier allows the direct current to be transmitted through a motorized alternating current spindle with maximum efficiency.

MILLER EXPANDS STANDARDIZED CYLINDER STOCKING PROGRAM

The number of standardized cylinder selections offered for immediate delivery has been boosted from 8,000 different combinations to more than 14,000 by Miller Fluid Power Division of Flick-Reedy Corporation.

The expanded program offers for the first time cushioning at either cap or head of the air cylinders. Cushioning — by means of an air or oil "pocket" at one or both ends of the cylinder — decelerates the piston velocity through the last $1\frac{1}{16}$" of its stroke. This feature is desirable in many high speed operations or where heavy masses must be stopped.

Frank Flick, president of the firm, reports that the expanded stocking program will cover 11 basic cylinder models of 200 psi air cylinders with bores ranging from $1\frac{1}{2}$" through 8", and 11 models of 2,000 psi hydraulic cylinders with bores of from $1\frac{1}{2}$" through 5".

Keep Informed • CATALOGS BULLETINS • SPECIFICATIONS

PUBLICATION

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

Case Histories of Consulting Jobs done for the jet engine industry are featured in a brochure offered by Winslow Mfg. Co., 1751 E. 23rd St., Cleveland 14. The company's creative engineering service for metalworking plants covers everything but the actual design of the product and its manufacture. For details on the service, obtain a copy of the brochure from the company, or —
Circle Inform-A-Gram No. B1.

Pierce Sheet Metal and Plate in short to medium production quantities with a complete line of turret punch presses. A bulletin presents specifications and information on all presses from the hand-operated Model R-2 to the 150-ton capacity R-15. Also described are three basic types of work locating gages for rapid, precise location of material without layout. For copies of Bulletin 201, write to Wiedemann Machine Co., Dept. 446, 4272 Wissahickon Ave., P.O. Box 6794, Philadelphia 32, or —
Circle Inform-A-Gram No. B2.

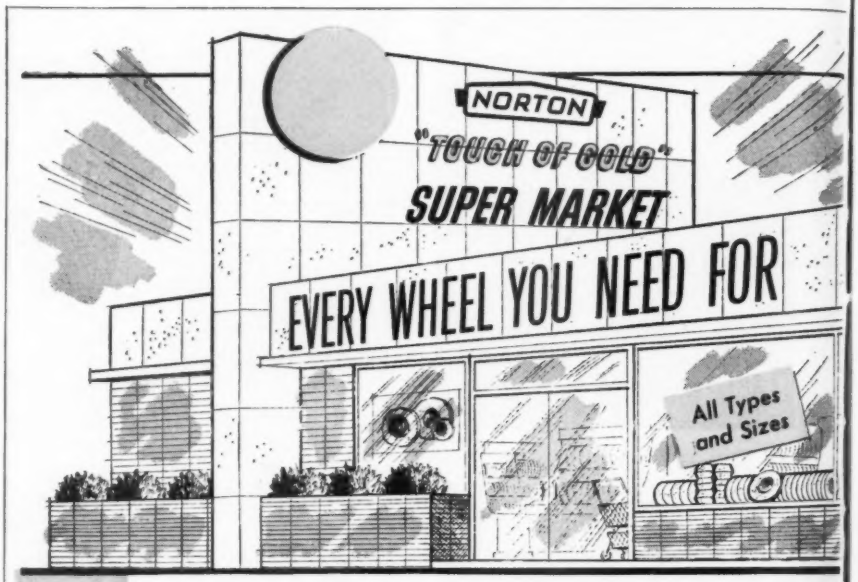
Hob Up to 144" between Centers with Model SH spline hobbing machine. It is designed primarily for the production of either straight or helical splines, but spur and helical gears can also be hobbed. Ease of setup adapts the machine to the job shop as well as to the production shop. The features of the hobber are detailed in Bulletin 94 made available by The Lees-Bradner Co., Cleveland 11, or —
Circle Inform-A-Gram No. B3.

Designed As A Quick-Connect, Self-Sealing Breakaway Coupler for fluid carrying hoses is Model 730-H hose coupler. It features easy push-pull operation, free flow of fluid, and self-sealing on both ends upon breakaway or disconnection. The hose coupler is used for service up to 2000 psi. For details and specifications, see a sheet on the coupler provided by Char-Lynn Co., 2843 — 26th Ave., S., Minneapolis 6, or —
Circle Inform-A-Gram No. B4.

Universal Shallow Dial Gages and Setting Master are highlighted in a bulletin supplied by WJZ Tool Specialties, E. Park Rd., Hyde Park, N. Y. Information is given on Models D and H gages and Model SM set master. Also found in the bulletin are gaging contacts and ordering information. Direct requests for copies of the bulletin to the company, or —
Circle Inform-A-Gram No. B5.

A New Line of Hack Saw Blades is described in an 8-page catalog now available from Heller Tool Co., Newcomerstown, O. Specifications and blade selection data in the catalog cover three types for power use and three for hand use. Included are suggestions for setting up power machines, determining speeds and feeds and using the Helometer tension gage to secure correct blade tension.
Circle Inform-A-Gram No. B6.

The Complete Precision Rebuilding and Reconditioning Operations on Warner & Swasey turret lathes that are performed by The DeSilvey Corp. are discussed in a new brochure. The 22 steps in the operation are detailed in the brochure. For complete information on this machine tool rebuilding service, request copies of the brochure from The De Silvey Corp., 200 Pennsylvania Ave., E. Aurora, N. Y., or —
Circle Inform-A-Gram No. B7.



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Take tool room grinding wheels. In these, as in all other categories, the Norton line is 100% complete. You don't have to shop around, you can get them all at Norton. And they're all the best wheels that can possibly be made. Because the advanced equipment and broad experience you find at Norton you'll find nowhere else in abrasives manufacture.

See Your Norton Distributor for wheels that will bring the value-adding profit-boosting "Touch of Gold" to all your tool room grinding operations. Ask him for the two helpful booklets — *A Handbook on Tool Room Grinding* and *How To Select Wheels For Precision Grinding Tool And Constructional Steels.* Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning Company, Troy, N. Y., a division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated. **For the booklets or other information write to Norton Company, Worcester 6, Massachusetts.**

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PREVIEWS

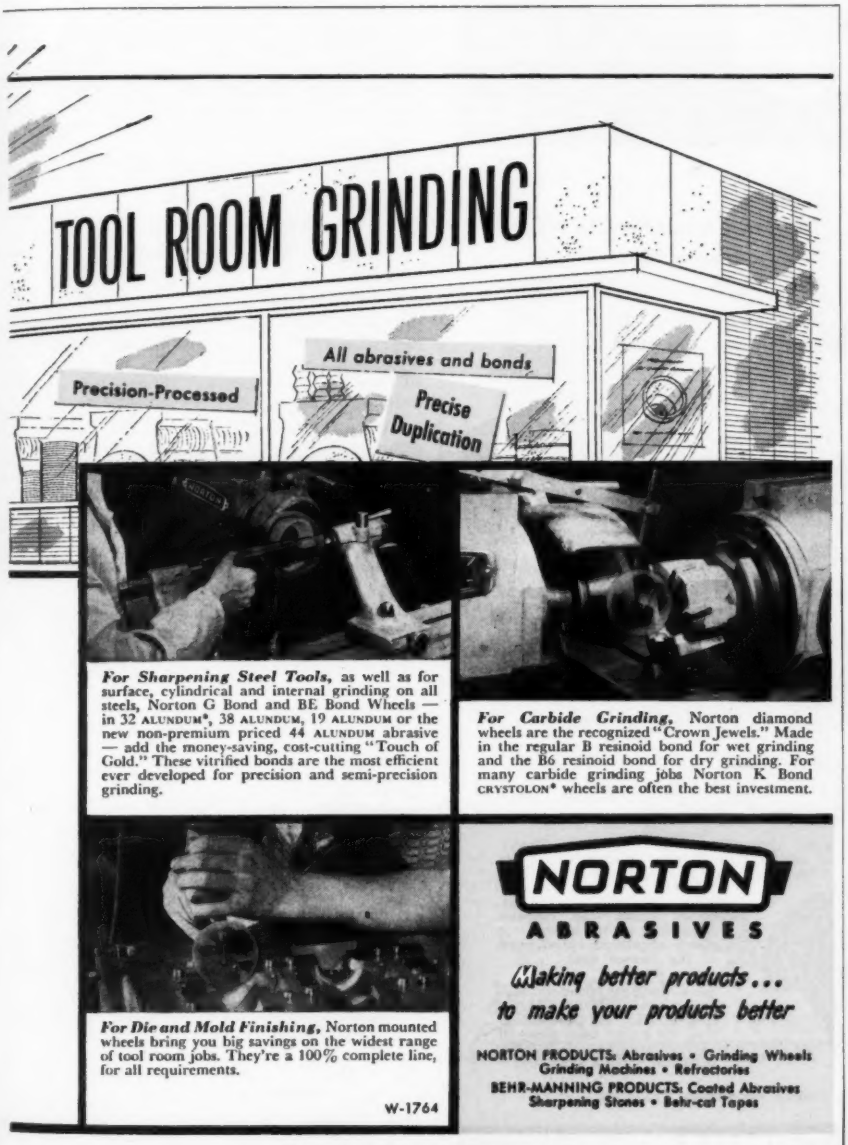
Circle postage-free Inform-A-Gram Key Number for your request

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

Grind Perfect Chamfers on tapped or hobbed chasers with the Chaso Model T grinding fixture. A bulletin shows the fixture in use on a cutter grinder. Also shown and described in the bulletin is Model M milled chaser chamfer grinding fixture. For complete details on these chaser chamfer grinding fixtures, see Bulletin 116 released by Chaso Tool Co., Inc., Box 268, North Branch, Mich., or—**Circle Inform-A-Gram No. B8.**

Die-Casting Machines are detailed in a new bulletin from The Cleveland Automatic Machine Co., Cincinnati 12, O. Covered are Models 50, 200, 400-N and 600 die casting machines designed to produce better castings faster. Each model is shown and described and its specifications listed. For further details on these machines, see the bulletin issued by the company, or — **Circle Inform-A-Gram No. B9.**

Adhesives, Coatings and Sealants are highlighted in an eight-page folder from Angier Adhesives, 120 Potter St., Cambridge 42, Mass. A two-page chart lists the company's adhesives complete with principle uses, characteristics, color, base solvent, application, etc. Also discussed are the company's service and facilities. The company will provide copies of the folder, or — **Circle Inform-A-Gram No. B10.**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All abrasives and bonds
Precise Duplication
For Sharpening Steel Tools, as well as for surface, cylindrical and internal grinding on all steels, Norton G Bond and BE Bond Wheels — in 32 ALUNDUM*, 38 ALUNDUM, 19 ALUNDUM or the new non-premium priced 44 ALUNDUM abrasive — add the money-saving, cost-cutting "Touch of Gold." These vitrified bonds are the most efficient ever developed for precision and semi-precision grinding.
For Carbide Grinding, Norton diamond wheels are the recognized "Crown Jewels." Made in the regular B resinoid bond for wet grinding and the B6 resinoid bond for dry grinding. For many carbide grinding jobs Norton K Bond CRYSTOLON* wheels are often the best investment.
For Die and Mold Finishing, Norton mounted wheels bring you big savings on the widest range of tool room jobs. They're a 100% complete line, for all requirements.
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NORTON PRODUCTS: Abrasives • Grinding Wheels Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cal Tapes
CIRCLE INFORM-A-GRAM KEY NO. 187

Capacities from 1 Oz/Hr to 4,000 Gal/Min are a feature of industrial spray nozzles manufactured by Spraying Systems Co., 3201 Randolph St., Bellwood, Ill. A catalog lists the nozzles in tabular form with complete data on the spray pattern, external dimensions, pipe size, orifice diameter, capacities and spray angles. Also covered is related equipment. For copies of illustrated Catalog 24, contact the company, or — **Circle Inform-A-Gram No. B11.**

Cut Most Materials at Speeds of 1,000 Sfpm and more with NewMet high velocity cutting material. It is designed to perform at normal carbide speeds or the higher ceramic and cemented oxide speeds. A bulletin presents cutting performance records. In addition, it lists stock sizes and prices. Newcomer Products, Inc., Latrobe, Pa., will issue copies of the bulletin containing details, or — **Circle Inform-A-Gram No. B12.**

Build Economical Equipment with Dexion slotted angle. This steel angle has diamond-shaped cutting marks accurately spaced 3" apart to assure proper measuring and cutting. A bulletin discusses the features of Dexion and pictures typical installations. In addition, the entire Dexion line is illustrated and described. Copies of the bulletin are supplied by Acme Steel Co., 2840 Archer Ave., Chicago 8, or — **Circle Inform-A-Gram No. B13.**

For Cutting, Gouging, Beveling or Grooving of All Metals, use the Arcair torch. A four-page bulletin covers the mechanical operation of the torch and discusses the Arcair process. Featured are numerous new applications for the Arcair torch. In addition, several case histories are shown and data on Arcair electrodes presented. Copies of Bulletin 6-1 are supplied by Arcair Co., 419 S. Mt. Pleasant St., Lancaster, O., or — **Circle Inform-A-Gram No. B14.**

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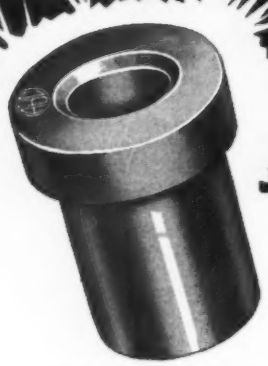
ABC ACCURATE BUSHING CO.



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CIRCLE INFORM-A-GRAM KEY NO. 1881

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standard circular FORM TOOLS and BLANKS. Over 600 sizes carried in stock for IMMEDIATE DELIVERY.

It's no longer necessary or economical to "hand grind" tools or purchase "made to order" tools for short run jobs. Let SOMMA STANDARD CIRCULAR FORM TOOLS give you uniform, correct dimensions, better finish and appearance, less set-up trouble. In short—maximum production at the lowest cost.

Send for new catalog now listing DAVENPORT STANDARD TOOLS and BLANKS as well as many new sizes of BROWN & SHARPE STANDARD TOOLS and BLANKS.

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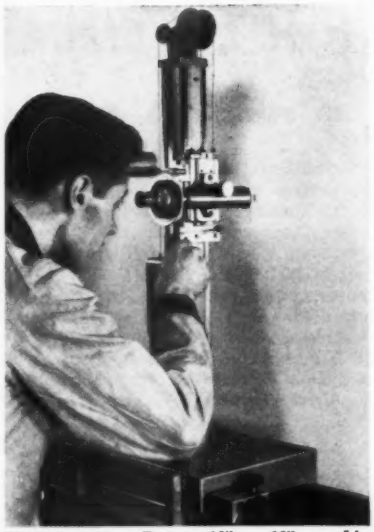
SOMMA TOOL COMPANY Inc.
Manufacturers of Standard and Special Precision Form Tools
14 BROWN STREET • WATERBURY, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 1882



M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

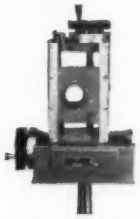
with new Gaertner Coordinate Cathetometers

These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.



M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

Write for Bulletin 188-53

The Gaertner Scientific Corporation
1242 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

CIRCLE INFORM-A-GRAM KEY NO. 1883

Move Stampings or Scrap from Press to Tote Bin with the Rapistan Press-Veyor, Jr. and the magnetic Press-Veyor belt conveyor. The Press-Veyor, Jr. cleated belt conveyor is a light-duty unit. The magnetic Press-Veyor using a magnetic field to keep stampings or scrap on its steeply inclined belt, is ideal in crowded areas. The Press-Veyor, Jr. is covered in Bulletin LPV-56 and the magnetic Press-Veyor in Bulletin MPV-56, both released by The Rapids-Standard Co., Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich., or—**Circle Inform-A-Gram No. B15.**

Broaching Accuracy of 0.0005" throughout the stroke is a feature of new vertical twin ram broaching machines. They are available in capacities ranging from 5 to 25 tons, stroke lengths from 30" to 100" and

cutting speeds between 4 and 35 fpm. An eight-page brochure details the machines and provides installation and specification data. Copies of the brochure are supplied by Detroit Broach & Machine Co., Rochester, Mich., or —
Circle Inform-A-Gram No. B16.

The Characteristics of Kennametal Grade K501 are presented in a new two-page bulletin from Kennametal Inc., Latrobe, Pa. Grade K501 is a tungsten carbide with platinum binder for severe corrosion. The bulletin also gives typical uses, workability, and physical and chemical properties. The company will provide copies of the bulletin containing details, or —
Circle Inform-A-Gram No. B17.

A Removable Stud Assembly for Conveyor Rolls is featured in a bulletin from Bearings, Inc., 3634 Euclid Ave., Cleveland 15. This assembly is reported to cut maintenance time to service conveyor rolls from hours to minutes. For further details, request a copy of the bulletin from the company, or —
Circle Inform-A-Gram No. B18.

The Complete Line of Campbell Abrasive Cutting Machines is graphically described in Bulletin DH-460-B released by American Chain & Cable Co., Inc., Campbell Machine Div'n, Bridgeport 2, Conn. These cut-off machines are made in many styles and models for both dry and wet cutting. Twelve models of varying capacities are pictured in the bulletin. Specifications are provided in tabular form. Also included is data on Allison abrasive cutting wheels.
Circle Inform-A-Gram No. B19.

New Features of Model 200 Centerless Lapping Machine are discussed in Bulletin L-56 released by Size Control Co., 2500 W. Washington Blvd., Chicago 12. Among the new features are steel pans under each set of lapping rolls to permit wet lapping and prevent losing small parts, a redesigned cabinet, and adjustable spacing between lapping rolls. The bulletin discusses lapping, pictures and describes the machine, and gives operating instructions.
Circle Inform-A-Gram No. B20.

Recent changes and additions provide many bonus features.

Unobstructed perimeter (work from any side!)

Six Wheel Models

Capacities to 5,000 pounds.

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The Handy HAMILTON Portable, Elevating Table

3 table surfaces 4 point support

Four Wheel Models

Special Designs too!

More Service for Less Money than Any other unit of equipment

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No. P-2408

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2408

CIRCLE INFORM-A-GRAM KEY NO. 189

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processes give you
- tremendous savings
- high production
- uniformity of finish

Savings on deburring, descaling, grinding, polishing, coloring and surface improvement by Roto-Finish barrel finishing processes are tremendous. Expensive hand finishing can be eliminated.

Results Guaranteed ! Send samples of finished and unfinished parts to Roto-Finish. Roto-Finish Sample Processing Laboratories will prove to you — before you buy — that Roto-Finishing will give you the results you want. Furthermore, Roto-Finish guarantees to produce the same results in your plant that are achieved in sample processing.

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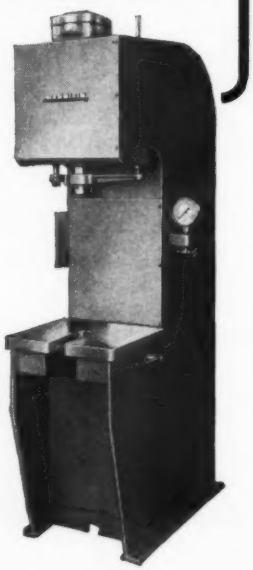
CIRCLE INFORM-A-GRAM KEY NO. 1901

PRICE LIST

ON HANNIFIN STOCK HYDRAULIC PRESSES



1-TON, Bench Type	$ 605
2-TON, Bench Type	$ 680
5-TON, with Base	$1,530
8-TON, with Base	$1,605
10-TON, Floor Type	$2,290
25-TON, Floor Type	$3,790

Prices complete with motors and starters F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

DELIVERY FROM STOCK

Demand for these popular presses is so consistent we are able to produce them in quantity and pass the savings along to you.

Construction-wise and quality-wise these small general-purpose presses are identical to the larger Hannifin presses, up to 150 tons. Special, optional controls when needed.

WRITE for complete information on the Hannifin Hydraulic Press you're interested in.

HANNIFIN

HANNIFIN CORPORATION, 563 S. WOLF ROAD, DES PLAINES, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1902

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- Does work require heavy duty machines . . . use Preis-Panto Model UE-3.
- Marking metal of extreme hardness, electrical or diamond drag . . . use Preis-Panto UE-M or UM.
- Preparing hardened steel or glass for acid etching. Ask for Preis-Panto Model UA-M.

There's a Model available to solve all your particular problems economically.

Preis is the "one source" solution for your engraving problems. Complete line of accessories and attachments are available for all makes and models.

TRADEMARK PANTO

Write for complete details and prices. For immediate attention write directly to manufacturer below. Ask for nearest representative.

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CIRCLE INFORM-A-GRAM KEY NO. 1903

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IT MAGNIFIES
IT ILLUMINATES
IT MAKES SEEING EASY

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OBLIQUE RAYS MAKE SCRATCHES & DEFECTS STAND OUT CLEARLY — GENUINE OPTICAL GLASS LENSES

HEAVY ADJUSTABLE BASE REMOVABLE LENS HOUSING FOR INSPECTION OF LARGE SURFACES, ENGINES, ETC.

3 MODELS AVAILABLE PRICED $23.50 TO $35.00

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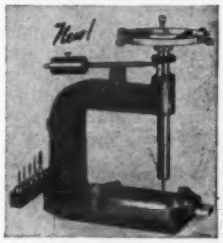
CIRCLE INFORM-A-GRAM KEY NO. 1904



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SUPERSENSITIVE HAND TAPPER

New exclusive features and top quality make Lassy Tappers outstandingly the finest available. Write for illustrated circular showing 3 models, and also Universal Tap and Die Guide.

LASSY TOOL CO. Plainville, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 1905

Hi-Pro Screw and Rivet Headers are highlighted in Circular 783-A-4 prepared by The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Covered are the 3/16" and 5/16" solid-die, double-stroke crank headers with respective production rates of 225 and 175 screw or rivet blanks/min, and maximum lengths of 1½" and 2⅝". Each feature is treated separately in the circular and a section devoted to special attachments. Also included are two tables containing standard tool sizes and header specifications.
Circle Inform-A-Gram No. B21.

Solid Carbide End Mills are covered in greater detail in revised Catalog 601 prepared by M. A. Ford Mfg. Co., Davenport, Ia. Presented is end mill data such as diameter, flute radius, shank diameter and

over-all length on 11 different types of mills. The 12-page catalog also contains information on other cutting tools such as HSS and carbide rotary cutters, countersinks and special tools. The company will provide copies of the catalog, or —
Circle Inform-A-Gram No. B22.

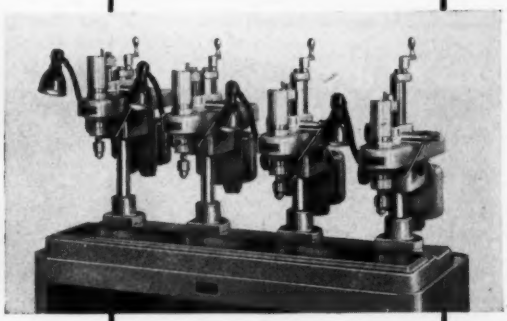
Polish or Finish Surfaces with Clemco wet hone machines and rooms. The various models manufactured are shown and discussed, complete with specifications, in a bulletin. In addition, the features and uses of wet hone are listed. For details, see the bulletin released by Clementina Ltd., 2277 Jerrold Ave., San Francisco 24, or —
Circle Inform-A-Gram No. B23.

A Complete Line of Hand and Electric Hoists is covered in Circular 163 prepared by Chisholm-Moore Hoist Div'n, Columbus McKinnon Chain Corp., 174 Fremont St., Tonawanda, N. Y. Included are illustrations, descriptions, and specifications for the various models available.
Circle Inform-A-Gram No. B24.

A Pul-Lift Catalog has been published by The Yale & Towne Mfg. Co., Yale Materials Handling Div'n, 11000 Roosevelt Blvd., Philadephia 15. Covered are roller chain and link chain Pul-Lifts. The lightweight ratchet hoist, which can be used for many industrial applications, is produced in capacities of from ¾ to 15 tons. Included in the catalog are features, illustrations, a dimensions and replacement parts price list table and general information.
Circle Inform-A-Gram No. B25.

The Redesigned Line of Trans-O-Mator straight line machine bases for automatic assembly is described in Bulletin 401 announced by Ferguson Machine Corp., Roller Gear Div'n, P. O. Box 5841, St. Louis 21, Mo. The bulletin discusses the advantages of standard machines over special designs. Typical applications and various design features are illustrated and dimensions given. Copies of the bulletin are supplied by the company, or —
Circle Inform-A-Gram No. B26.

HAMILTON
SUPER SENSITIVE, SMALL-HOLE
PRECISION
REPEAT
PRECISION
DRILLING MACHINES



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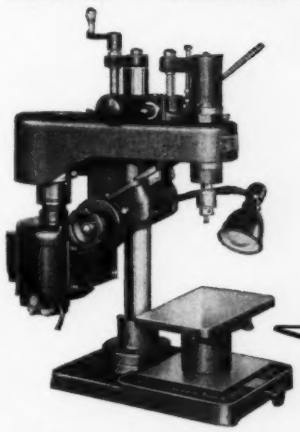

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WE WILL SUPPLY IT
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CIRCLE INFORM-A-GRAM KEY NO. 191

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Pays for itself time and time again. Will sharpen as many as 250 Milling Cutters, Slitting and Screw Slitting Saws .015" thick at one time with a variation, plus or minus .001" of exact diameter for entire lot. Automatically indexes the gang of saws, one row of teeth at a time.

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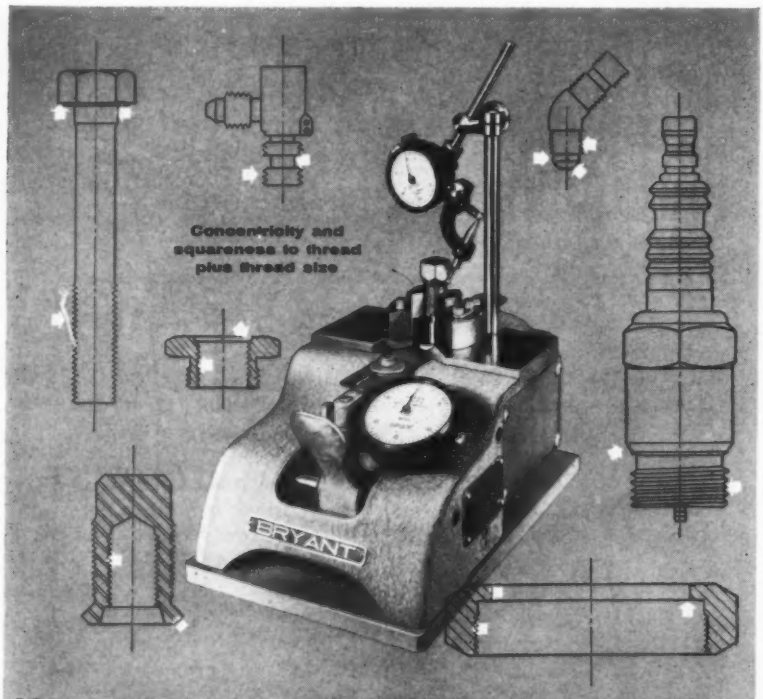

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CIRCLE INFORM-A-GRAM KEY NO. 1922

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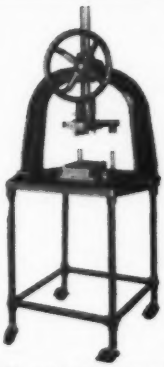

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Lacey Die-Set Machine

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the die-maker to complete a die-set at his bench . . . saves toolroom and handling costs. Ask today for full details.

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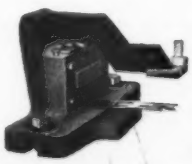
CIRCLE INFORM-A-GRAM KEY NO. 1924



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6" wide **$95.00**
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96 High St., Hingham, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 1925

Production Tools are highlighted in Catalog 1000 from Commander Mfg. Co., 4225 W. Kinzie St., Chicago 24. Covered are Multi-Drill, tapper, Select-A-Spindle, drill chip breaker and Multi-Tapper. Also included in

the catalog are the Lead-Matic and Pneu-Matic tappers and Multi-Angle drill unit. Each tool is detailed complete with applications and specifications. Get your copy of the catalog from the company, or —
Circle Inform-A-Gram No. B27.

Fast, Automatic Machining of Large, Complex Workpieces in one operation is performed by the 3AC single spindle chucking automatic produced by The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3. The machine sets up quickly like a turret lathe, uses standard turret lathe tooling, and changes speeds and feeds automatically under cut. For complete details, see Bulletin 5613 issued by the company, or —
Circle Inform-A-Gram No. B28.

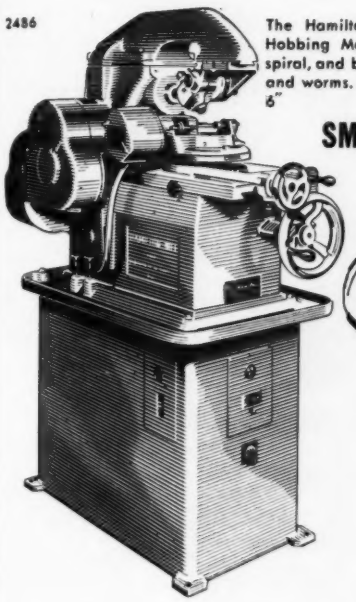
Easy Tooling Installation and Arrangement are possible with Toolmor air cylinders. Their design provides compact sizes in all strokes. Universal mounting permits either horizontal or vertical thrust use. The cylinders are available with standard, ball, swivel or threaded piston ends. A bulletin describing the cylinders and presenting mounting diagrams is issued by Burklyn Co., 3429 Glendale Blvd., Los Angeles 39, or —
Circle Inform-A-Gram No. B29.

Floor Trucks are highlighted in Booklet 57-S from Nutting Truck and Caster Co., Fairbault, Minn. Illustrated and described are trailers, drag-line trucks, dollies, jacks and skids, etc. In addition to specifications, many "in use" illustrations are included in the booklet, which can be obtained from the company, or —
Circle Inform-A-Gram No. B30.

Feed, Orientate and Count Up To 200,000 Items/Hr with the Feed-A-Matic parts feeder. It is completely adjustable for size, shape and count, and will handle a wide range of items. A bulletin notes the features, and points out and discusses each of them. In addition, it gives the applications and lists typical speeds for standard products. Get your copy of the bulletin from U. S. Engineering Co., 40-24 - 22nd St., Long Island City 1, N. Y., or —
Circle Inform-A-Gram No. B31.

Welded Steel Tubing is highlighted in a new manual published by Armco Steel Corp., P. O. 856, Middletown, O. Described is tubing formed from Zincgrip, aluminized, hot rolled, and cold rolled steels. Pressure tested tubing and fabricated parts are also included. There are sections on structural advantages, how the tubing is supplied, mechanical properties and fabrication. In addition, the manual contains tables, drawings and photos of applications.
Circle Inform-A-Gram No. B32.

2486



The Hamilton No. 1-B Precision, Small-Gear Hobbing Machine. Generates precision spur, spiral, and bevel gears, face gears, worm gears, and worms. Maximum diameter of work piece, 6"

SMALL PRECISION

Gears without tears

HERE'S WHY

The Hamilton Precision, Small-Gear Hobbing Machine, the hobber with a "reserve of accuracy," regularly holds work spindle and hob spindle run out to less than .0002", work spindle and tailstock spindle alignment to less than .0002". ***And this standard of workmanship is maintained throughout the machine.***

FURTHER

Speed, feed, and indexing each can be selected individually and independently. ***THINK*** OF THE TIME TO BE SAVED BECAUSE OF THIS ***ONE*** FEATURE!! And scores of additional features are described in our Gear Hobber Bulletin No. 2486 which we will be glad to furnish to you FREE.

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ADDRESS

THE HAMILTON TOOL COMPANY
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HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 193

Machine Turning and Cutting Tools are highlighted in the bulletin from Diamonite Products Div'n of U. S. Ceramic Tile Co., Canton 2, O. Included are standard shank type turning tools; rectangular, and lathe and grinder center blanks; inserts; and toolholders. Also discussed in the bulletin are machining hints and advantages of the tools. In addition, the applications are listed. Contact the company for copies of the bulletin, or —
Circle Inform-A-Gram No. B33.

Expanding Jaw Mandrels are covered in a four-page bulletin from Erickson Tool Co., E. 23rd and Hamilton Ave., Cleveland 14. Described are both the Type A step-jaw design and the Type B straight-jaw design mandrels. The bulletin, illustrated with product and application photos, gives dimensions, data on the various sizes and complete prices. Copies of the bulletin, "Erickson-Nicholson Type Expanding Jaw Mandrels," is made available by the company, or —
Circle Inform-A-Gram No. B34.

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VISES
with exclusive "CIRCLE-GRIP" LOCKING MECHANISM
The fastest—safest—most accurate line of screwless type holding devices ever offered to industry.
Grip-Master jig and fixture base
JUST ADD BUSHING, FALSE JAWS & BACK PLATE
TO DRILL HOLE IN SPROCKET ARM
The Grip Master drill jig, shown in the above illustration, cost a Heinrich customer $60.00. Original drill jig design was estimated at $250.00. This is just one example of how you too can cut tooling costs with the Heinrich jig and fixture formula.
Sets and Locks in a Flash!
Speedy loading and unloading cuts production costs.
4 GREAT GRIP-MASTER WORK SAVERS
Heinrich Grip-Master Fixture lock on multiple drill jig.
The Grip-Master Fixture locks make jig and fixture designing easier—does away with locking details and troublesome clamps.
Tool steel cuts faster, safer when locked in the grip of a Heinrich band saw vise. Unlike other Heinrich Vises guide bar is of soft cold roll steel to prevent damage to saw blade—shoulder screws are removable for chain feed.
Heinrich Band Saw Vise leaves hands clear of saw for safe operation.
Heinrich Safety Drill Vise, with built-in recessed parallels, holds work square. Vertical V-groove provides positive grip on rounds—table mounting attachment does away with clamps, straps, and adapters. Vise cannot swing off table.
Heinrich Safety Drill Vise increases production with accuracy.
Write for free catalog—learn how Heinrich Grip-Masters can cut tooling costs.
heinrich
HEINRICH TOOLS, INC., Dept. 137D, Racine, Wisconsin
CIRCLE INFORM-A-GRAM KEY NO. 194

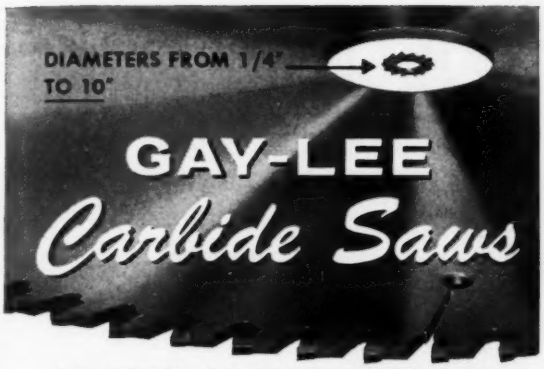
Gage Products are described and illustrated in a 40-page catalog prepared by Cadillac Gage Co., P. O. Box 3806, Detroit 5. Presented are complete specifications, prices and sizes for the line of thread plug,

thread ring and special gages produced by the company. One section is devoted to Pla-Chek gages which are used for fast, accurate surface plate inspections. The company will provide copies of the catalog, or —
Circle Inform-A-Gram No. B35.

Tooling Requirements for Chemical Milling are specified in detail in Bulletin 3 from United States Chemical Milling Corp., 1700 Rosecrans Ave., Manhattan Beach, Calif. Outlined are three optional procedures for producing the templates required to chemically mill flat or formed parts in aluminum and magnesium. Also included are complete chemical milling inspection template specifications.
Circle Inform-A-Gram No. B36.

The Complete Line of Ses-Matic Press Room Equipment is presented in a 12-page catalog issued by Special Engineering Service, Inc., 8161 Livernois, Detroit 4. Given are the features and complete specifications for all Ses-Matic equipment and technical data pertaining to steel coils and various other alloy stock. Also included in the catalog is information on capacity, application and characteristics of the equipment.
Circle Inform-A-Gram No. B37.

Standard Inserts are the subject of a catalog issued by Standard Insert Co., 12270 Montague, Pacoima, Calif. They are used for plastics, sheet metal and electronics applications. Diagrams and specifications are given for each of the types available. One section is devoted to showing examples of special inserts and studs. Get your copy from the company, or —
Circle Inform-A-Gram No. B38.



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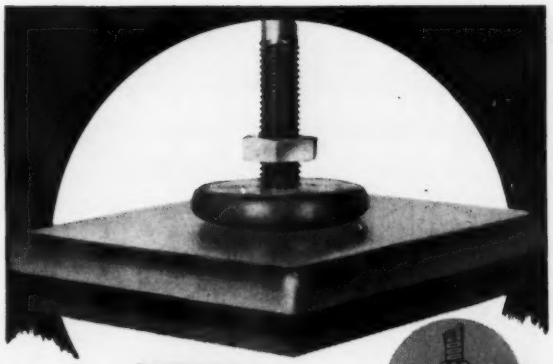
Make tough production problems easy with the Gay-Lee carbide-tipped "Thinsaw." Even when wafer-thin for the most delicate work, these saws provide positive alignment and rigidity that allow cutting free of run-out to full depth. Carbide tips for speed and long life, expertly brazed into a specially designed, patented seat that secures them firmly. Thickness as low as .030", thickness tolerances can be held to .0001", diameters ¼" to 10". Send details of your problem for recommendations and quotations.

GAY-LEE COMPANY
CLAWSON • MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1951



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The new Level-Rite combines the features of Unisorb with the advantages of a rugged, easy-to-use device for precise leveling of machines. Machines are completely "mobilized." One unit required for each machine leg, with load ratings to 7500 lbs. per unit.

Exclusive Screw-Post Design . . . Machine legs mounted on special leveling screw and plate assembly, which rests in all-steel base plate. Machine is quickly and easily leveled by simply rotating the square top of the leveling screw, then securing lock nut. Machines stay level.

No bolts, lag screws or cement . . . Level-Rite eliminates all need for anchor bolts or screws. Designed so compression provides positive hold, no "walking" or creeping under the toughest side loads.

Superior Unisorb Vibration Dampener . . . Industry's most efficient isolator reduces transmitted vibration up to 85%. Unisorb will not deteriorate, is resilient, and is impervious to cutting fluids and cleaning compounds.

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CIRCLE INFORM-A-GRAM KEY NO. 1953

FREE... 64 PAGE CATALOG

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CIRCLE INFORM-A-GRAM KEY NO. 1952

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MODEL-1000

for mechanized and continuous rolling parts flow between production machines

■ Save manpower. Cut material handling costs between machines and work stations. Remove work pieces from one machine and transfer to another automatically. The Transfer Conveyor is easily adjusted to your machines' production speeds to assure maximum production efficiency. For practical recommendations on your specific parts feeding problem, send prints or sample parts.

FEATURES:
- **Complete package: silent chain conveyor, motor, variable speed transmission, adjustable speed controls**
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Designers and Builders of Automatic Production Feeding Equipment

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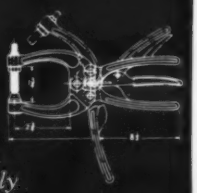
announcing...
TRIGGER-RELEASE
levers on 5 more
DE-STA-CO
PORTABLE
TOGGLE CLAMPS

MODEL 462
Trigger-Release levers also available on DE-STA-CO Toggle Clamp Models 461, 462-S, 463, and 463-S (jaw spans ranging from ½" to 3").



For a one-handed clamping job . . . especially in a hard-to-get-at place . . . there's *nothing, absolutely nothing,* as good as a Trigger-Release DE-STA-CO Portable Clamp! . . . And now, with 5 more new models, we meet practically every such clamping requirement.

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WORLD'S FIRST LINE OF TOGGLE CLAMPS
344 Midland Avenue • Detroit 3, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1961

PALMGREN
DRILL PRESS AND ANGLE VISES
Can speed up production, solve difficult angle jobs in your plant. Used in all industries — everywhere.

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Drill Press Vise
1½" Jaw width, $6.95

No. 30
Drill Press Vise
2½" Jaw width, $8.95

No. 320
Drill Press Vise
3" Jaw width, $10.95

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Drill Press Vise
4" Jaw width, $19.95

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Angle Vise
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No. 24B
Angle Vise
4" Jaw width, $39.95

NO 114

There are 64 different models and types of Palmgren vises, rotary tables, milling attachments and other machine tool accessories, comprising the most complete line of vises and tables available anywhere, with jaw sizes from 1½" to 8". **Send for catalog 204 for complete line,** showing details and prices.

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CIRCLE INFORM-A-GRAM KEY NO. 1962

GEORGE L. DETTERBECK CO.
SINCE 1911
World's Largest Exclusive Manufacturer of
SCREW MACHINE TOOLS!

CUTTING CAMS
HIGH SPEED STEEL AND CARBIDE FORM TOOLS
SPECIAL CUTTING TOOLS
SPLIT DRILL BUSHINGS
CROSS SLIDE KNURL HOLDERS
TOOL BITS
BOX TOOLS
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RECESS SWING TOOLS
FORMING SWING TOOLS
Standard sizes 00, 0, 2, carried in stock.

We specialize in one thing only... designing and making SCREW MACHINE TOOLS!
45 years experience goes into every tool we make. They come to you ready for use... Precision design... Skilled workmanship... Finest materials.
Our extensive facilities save you TIME... MONEY... and give you accuracy, quality and quick service.
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1871 Clybourn Avenue • Chicago, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1963

Commander
TAPPER
★ Wider Range...1 Tapper Handles #0 to ¾" Taps
★ Automatic Tap Protection

★ Furnished to fit any Drill Press

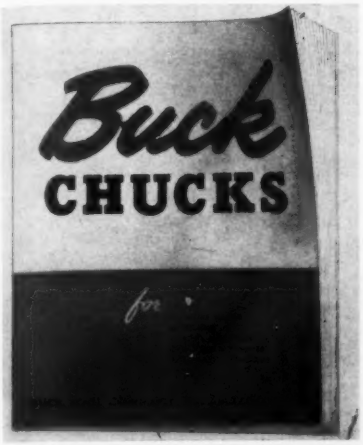
Commander—"The Tapper That Thinks For Its Operator," has the adjustable full range torque control that instantly stops any tap when it becomes dull, loaded, strikes a hard spot or bottoms in blind hole tapping. Assures maximum tap protection, higher production, even with inexperienced operators.

Your nearby Commander Distributor can give you a demonstration in your own plant. Write for his name and a copy of the NEW Commander Full Line Catalog.

COMMANDER MFG. CO.
4238 W. Kinzie St. Chicago 24, Ill.
Product of *Commander*... Builder of Production Tools

CIRCLE INFORM-A-GRAM KEY NO. 1964

A Complete Catalog on Chucks has been released by Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich. Featured are the company's five "firsts" in chuck development. In



addition, the catalog describes the Ajust-Tru principle and lists mounting plates, accessories and power unit components. Obtain copies of the catalog from the company, or —
Circle Inform-A-Gram No. B39.

A Quick Guide to Sheet Metal Hand Machines and Tools is provided by Booklet 201 published by Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11. The illustrated 32-page booklet contains summarized data and descriptions of all important models. For complete information on any item, references are made to specific Niagara bulletins. Direct requests for Booklet 201 to the company, or —
Circle Inform-A-Gram No. B40.

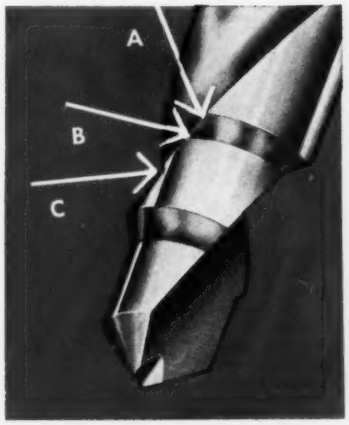
A New Edition of the RLM Standard Specifications for Industrial Lighting Units has been published by the RLM Standards Institute, 326 W. Madison St., Chicago 6. Presented is the new coefficient of utilization tables for eight different incandescent and fluorescent lighting units. Also included are revisions in specifications on both industrial lighting units. The Institute will supply copies of the book, or —
Circle Inform-A-Gram No. B41.

Designed for Aircraft Application is the Torq-Set fastener produced in the 100° flat head design. A booklet telling about the fastener discusses the importance of wrenchability, the nine elements of successful design, and driver and impact strengths. In addition, the various features of the Torq-Set fastener are detailed. For further information, obtain a booklet from American Screw Co., Willimantic, Conn., or —
Circle Inform-A-Gram No. B42.

Quickly and Accurately Measure Longer Length, Larger Diameter Threads with Bench-Model SK-1003 lead comparator. It is used to inspect lead of worms, gages, bolts, taps and lead screws. In addition, the comparator checks spacing of holes, grooves, notches, etc. Descriptive information, the comparator's range and the accessories available are presented in literature made available by Jerpbak-Bayless Co., Solon Rd., Solon, O., or —
Circle Inform-A-Gram No. B43.

Indox V for High Energy Ceramic Permanent Magnets is discussed in Bulletin 16 published by The Indiana Steel Products Co., Valparaiso, Ind. Indox V has an energy 3½ times that of conventional ceramic magnets. The typical characteristics, magnetic properties and design possibilities of the new material are covered in the bulletin. In addition, its design advantages and limitations are pointed out and the standard sizes available shown.
Circle Inform-A-Gram No. B44.

Almost any tool you use is a better tool if you grind it with R-O



Ground form relief of cutting edges (A), is as easy to obtain today as ordinary angular back off. With the R-O fixture you get other obvious advantages such as no undercutting at intersections (B), any amount of circular margin on non-cutting edges (C), etc. It all adds up to this — you get better cutting and up to double the cuts per grind. Write for the R-O catalog.

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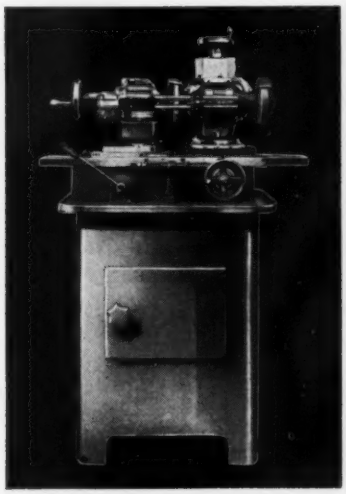
FORM RELIEVING
FIXTURE
R-O Grinder
ROYAL OAK TOOL & MACHINE CO.



CIRCLE INFORM-A-GRAM KEY NO. 197

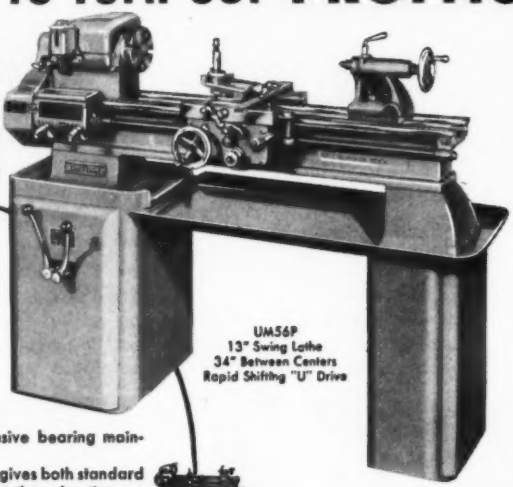
A New Line of Bench and Small Presses is detailed in Bulletin 1-A recently released by E. W. Bliss Co., Canton, O. Complete information and engineering data are given on four and seven-ton inclinable bench presses, four and ten-ton adjustable bed and horn presses, and a ten-ton floor mounted inclinable press. Also described is the rolling key clutch which is standard on all these presses. Direct requests for the bulletin to the company, or —
Circle Inform-A-Gram No. B45.

High Speed Contouring, Pocketing and Swarf Cutting of aluminum, titanium and steel are performed by the Arrow profiler. This machine provides the power, rigidity and speed range necessary for close tolerance machining of irregular contours. A bulletin details the machine's features, gives specifications and shows the profiler in action. For copies of Bulletin PR-156, contact Arrow Engineering Co., Inc., 120 E. Market St., Indianapolis, Ind., or —
Circle Inform-A-Gram No. B46.

SHELDON
CHICAGO U. S. A.

BUILT
• • • to Turn out PROFITS

Sheldon Lathes are designed and built to do accurate lathe work rapidly and profitably. Moderate in price they have the collet, swing and power capacity to do most toolroom work.



UM56P
13" Swing Lathe
34" Between Centers
Rapid Shifting "U" Drive

Design Features:
- Large and wide "Zero Precision" Tapered Roller Spindle Bearings—permit operation at all speeds, retain accuracy, end expensive bearing maintenance costs.
- 54-pitch Gear Box—gives both standard and many hard to get thread ratios.
- Large Micrometer Dials—Make accurate operation easier.
- Extra Collet Capacity—1⅜" hole through spindles available on 10", 11" and 13" swing lathes.
- More Power to Spindle—Efficient drives with bigger motors and double neoprene cog V-belts to spindle.

OPTIONAL FEATURES AT EXTRA COST
include: Hardened ways, Long Tapered Key Drive Spindles, 4" D1 Camlock Spindles bed turrets, collet attachments, and other production and toolroom accessories. Lathes available with a choice of "Bench," "Cabinet" or "Pedestal" mountings.

Write for New Catalog G-55

SHELDON MACHINE CO., Inc.
4235 N. Knox Ave. • Chicago 41, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 198

Measure and Record Surface Profiles with the Proficorder. A four-page bulletin shows close-up photos of the three principal parts of the instrument — pilotor, tracer and amplicorder. In addition, it contains reproductions of the chart records.

The bulletin also suggests practical applications for studying and analyzing surfaces or determining size, shape and location of waviness and other irregularities. Copies of the Proficorder Bulletin can be had by contacting Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich., or
Circle Inform-A-Gram No. B47.

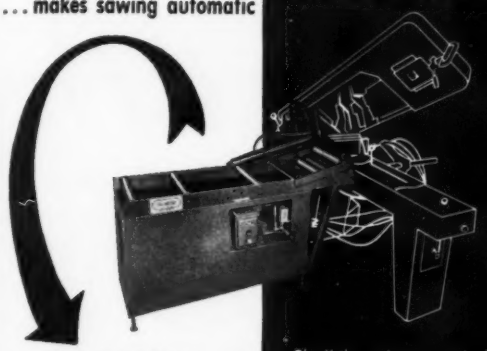
Milling Cutters Can Be Mounted Flush using the Peterson stub arbor. It adds versatility to vertical and horizontal milling machines. The arbor permits a side-milling cutter to do the work of a large shell end mill. It fits 40 different cutter sizes. For complete details and specifications on the arbors available, request literature from Sierra Machine Co., Inc., 80 E. Jackson Blvd., Chicago 4, or —
Circle Inform-A-Gram No. B48.

An Increased Size Range of Die Buttons has been announced by Pivot Punch and Die Corp., Punch Div'n, N. Tonawanda, N. Y. Ball seat retainer die buttons and press fit die buttons are now offered in 333 hole diameter sizes at reduced prices. They are listed on a catalog sheet recently published. Copies can be obtained from the company, or —
Circle Inform-A-Gram No. B49.

Hydraulic Cylinders are the subject of a bulletin from Densmore Engineering Co., Inc., 235 Greenleaf, Compton, Calif. The features and specifications for the cylinders are listed. Included are diagrams and an illustration pointing out the component parts of the cylinders. Obtain copies of the bulletin from the company, or —
Circle Inform-A-Gram No. B50.

The KALAMATIC ... makes sawing automatic

AUTOMATIC BAR-FEED ATTACHMENT



Featuring:

- Quick easy installation and adjustment.
- Accurate repetitive cutting with no intricate electrical equipment to go out of balance.
- Completely enclosed oil tank and ball bearing table rollers.

The Kalamatic automatically feeds rounds, flats, hex, pipe, tubing to most Kalamazoo metal cutting band saws—any length from 3/16" to 30". Thoroughly automatic, The Kalamatic helps prolong the blade life of the saw.

Machine Tool Division
Kalamazoo TANK and SILO CO.
508 HARRISON ST.
KALAMAZOO, MICHIGAN

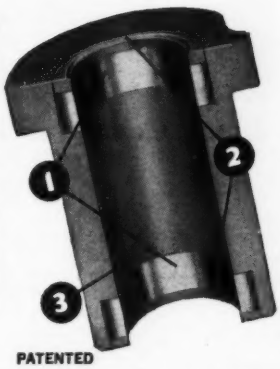
CIRCLE INFORM-A-GRAM KEY NO. 1991

MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES *IN Automation!*

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 41.



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 1992

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

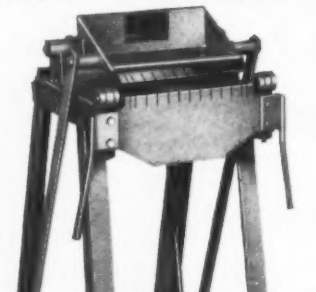
The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY
ABERDEEN, SOUTH DAKOTA

CIRCLE INFORM-A-GRAM KEY NO. 1993

BEND DRUM RETURN FOR LETTERS FASTER!



3/16" SLOTS
¾" DEEP ON
1" & ½" CENTERS
ACCOMMODATE
SEAMED & FOLDED
DRUM RETURN

CLAMPING BY
FOOT TREADLE

CAPACITY 20 GA.
INCLUDING
STAINLESS

HEIGHT 39"

WEIGHT ONLY
50 LBS. FOR
EASY MOVING

WHITNEY-JENSEN NO. 99
Letter Forming Bending Brake

WHITNEY METAL TOOL COMPANY
712 Forbes St., Rockford, Ill. *Since 1910*

CIRCLE INFORM-A-GRAM KEY NO. 2001

new SCHERR TOOLMAKERS MICROSCOPE

WITH INTERCHANGEABLE DIAL TEMPLETS AND OCULARS

57
58
59
Reading Angles in Minutes
Thread Templets for U.S. National Thread Profiles-6-80 Pitch. Radii Templets, etc.
LARGE MICROMETER DRUMS READ DIRECTLY IN .0001"
Measuring Range 2" x 1-1/2" and other sizes
A moderately priced PRECISION MEASURING TOOL for Toolroom and Inspection

WRITE FOR CATALOG—Code YGIIQ

GEORGE SCHERR CO., Inc.
COMPLETE LINE OF PRECISION INSTRUMENTS
200-T LAFAYETTE STREET • NEW YORK 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2002

ONE Clark LATHE TOOL HOLDER Grips 3 bit shapes

Square Bits

Round Bits

Cut-off Bits

Threading Bits

Many Bit Sizes!

Clark LATHE TOOL HOLDERS do the *USUAL* and *UNUSUAL* JOBS BETTER IN EVERY SHOP—*SOLIDLY GRIP* ROUND, SQUARE and RECTANGULAR SHAPES—Enable turning, threading, boring with bars as well as cut-off operations with *ONE* tool holder!

Special vee clamp operating on diagonal accommodates several bit sizes, grips *full length of the cutter channel.* Holds bits tighter, eliminates chatter and harmonic vibration. Excellent rigidity for carbide tools!

4 Clark Lathe TOOL HOLDER SIZES cover complete range of lathe requirements from ⅛" bits to ⅝" bits. Write for prices or order from your dealer.

Robert H. Clark Company
9330 Santa Monica Blvd., Beverly Hills, California

CIRCLE INFORM-A-GRAM KEY NO. 2003

"HILLCO" TANGENT CHASERS

A NEW NAME FOR AN OLD ESTABLISHED PRODUCT

In the interests of standardization the line of ACME Tangent Chasers have been modified slightly in dimensions so that they now are adaptable to other makes of die heads in addition to ACME die heads.

This complete line of tangent chasers is now known as "HILLCO". "HILLCO" tangent chasers can be reground for 80% of their original length. The same precision and long wear are guaranteed that have made our chasers a standard through 75 years of cutting tool manufacture.

TOOLS FOR INDUSTRY

THE HILL ACME COMPANY
ACME MACHINERY DIVISION
1203 West 65th Street • Cleveland 2, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2004

Matic and Tufmatic Brushes are detailed in a folder published by The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland. The Matic Brush maintains precise brushing action under rigorous continuous use. The Tufmatic Brush is designed to do a stronger brushing action than the Matic for removing burrs and scale which are difficult for other brushes to do effectively. Shown are actual on-the-job operations, brush specifications and charactertistics. One section is devoted to adapters for use with the brushes.
Circle Inform-A-Gram No. B51.

Features Plus Application and Selection Data on LXS bushed roller chains are found in Book 2454 released by Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1. The balanced design of the chain provides extra strength, increased wear resistance and wide application flexibility. The chain is manufactured in two designs — straight or offset sidebars. For further details, get the literature from the company, or —
Circle Inform-A-Gram No. B52.

The Leitz 6" Jig Borer is the subject of an eight-page catalog. With a permanent accuracy of 0.00008", this jig borer is designed for the most exacting requirements in producing jigs and fixtures, gages, instrument parts, etc. Layout, scribing, spotting, drilling, boring, and final inspection of the work are all done in one setting without removing the piece from the table. For complete details, request copies of Catalog 82-4 from Opto-Metric Tools, Inc., 137 Varick St., New York, or —
Circle Inform-A-Gram No. B53.

The Advantages and Specifications of a new, heavy-duty, versatile 15" drill press are contained in a four-page bulletin. Covered are 40 different models of the tool including bench or floor model, high or slow speed, Morse taper or key chuck spindle, single or multiple spindles, and standard or production table models. Components and accessories are also listed. For your copy of the bulletin, write to Delta Power Tool Div'n, Rockwell Mfg. Co., 469 N. Lexington Ave., Pittsburgh 8, or —
Circle Inform-A-Gram No. B54.

400 Components for Jigs and Fixtures are covered in Catalog 26 prepared by Northwestern Tool & Engineering Co., 116 Hollier Ave., Dayton 3, O. Included are three new types of toggle shoe clamps. Each item is illustrated and specifications and prices listed. Obtain copies of the catalog from the company, or —
Circle Inform-A-Gram No. B55.

Designed for High-Speed Nut Running, particularly on applications involving multiple-unit tools, are Fast Lead sockets. A bulletin describes them and Surface Drive sockets which are used where perfect alignment of socket and nut or bolt is not always possible. The complete line of Fast Lead and Surface Drive sockets is listed in Catalog 129 which is made available by The Apex Machine & Tool Co., 1037 S. Patterson Blvd., Dayton 2, O., or —
Circle Inform-A-Gram No. B56.

Air and Hydraulic Cylinders are featured in Bulletins 101A and 105 from Ortman-Miller Machine Co., Inc., 21 - 143rd St., Hammond, Ind. In 28-page Bulletin 101A are covered 150 psi air and up to 1500 psi hydraulic cylinders. Hydraulic cylinders up to 2000 psi are featured in eight-page Bulletin 105. The cylinders and mounts are illustrated and described with detailed construction features, capacity charts and engineering data.
Circle Inform-A-Gram No. B57.

WICKMAN-BROWN *Fully Floating*
MICROMETER ADJUSTABLE REAMERS

Typical Applications:
- LATHES
- TURRET LATHES
- MULTI SPINDLE AUTOMATICS
- CHUCKING MACHINES
- SINGLE SPINDLE AUTOMATICS
- VERTICAL AND HORIZONTAL BORING MILLS
- JIG BORERS
- GENERAL TOOL & DIE ROOM AND SHOP MAINTENANCE

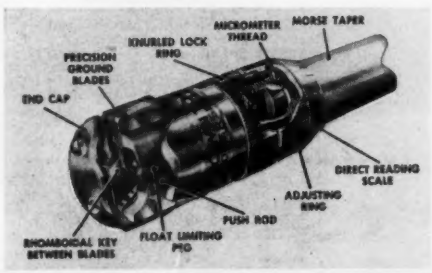
Type S for through hole reaming.
Type SL for blind hole reaming.
Range in Sizes: ¾" to 8" in only 18 units

Type SO for through hole reaming only—range from ½" to ¾" in ONLY 5 Sizes.

The initial cost of a Wickman-Brown reamer is your last major expenditure. The blades, available in both high speed steel and tungsten carbide, are precision ground and may be sharpened repeatedly without affecting micrometer reading.

Eliminates costly floating tool holders by built-in positive and predetermined float.

Down time is eliminated on production due to micrometer adjustability without removal of blades or unit from machine.



Distributors' Inquiries Invited

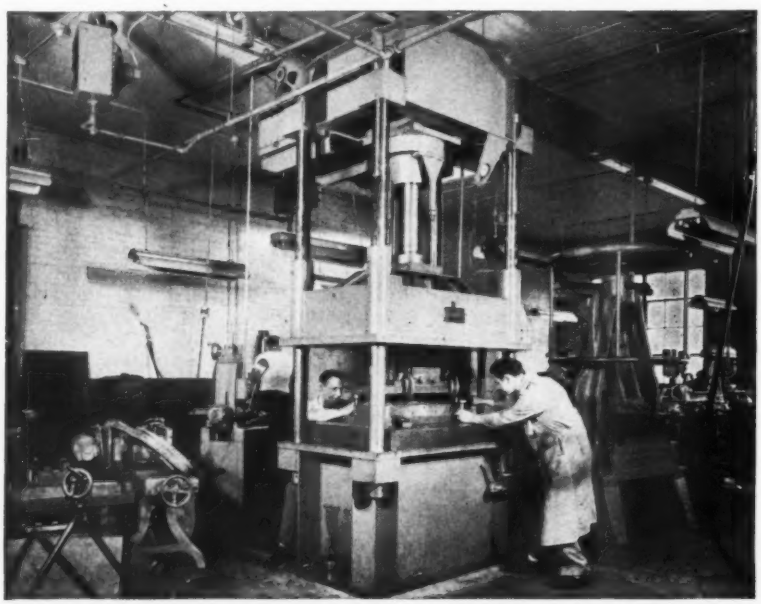
THE Wickman MANUFACTURING CO.
10329 CAPITAL AVENUE (OAK PARK) DETROIT 37, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 201

"Friction Sawing" covers the use of Tannewitz high speed band saws. They can be used to cut sheet steel, non-ferrous metals, armor plate, soft or hardened steels and plastics. The illustrated booklet contains sections on useful frictional heat, friction cutting by band saw, and cutting plastics. In addition, the various models in the Tannewitz line are shown and described. The Tannewitz Works, 301-325 Front Ave., N.W., Grand Rapids 2, Mich., will provide copies of the booklet, or —
Circle Inform-A-Gram No. B58.

Oil Hardening Tool Steel is the subject of Bulletin 14-14 now available from Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80. Ry-Alloy is supplied in rounds, squares and flats for applications ranging from arbors and clutch dogs to thrust washers and trimming dies. Its features include safe hardening, minimum distortion and good machinability. The bulletin gives typical analysis, heat treatment and forging practice. Get your copy from the company, or —
Circle Inform-A-Gram No. B59.

Separate Adjustment of Air Supply and Coolant is possible with a new dual valve control mist coolant system. With the Trico-Mist coolant system, the coolant mixture can be varied from a very fine invisible mist to a maximum discharge. It can be operated on 25 to 125 lbs air pressure. Details on the system which is used to extend the life of drills, taps, mills and other cutting tools and dies, are found in Bulletin 37-A from Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, or —
Circle Inform-A-Gram No. B60.



The diemaker who made a nuisance of himself

This is the story of Three Star Manufacturing Co. — a custom diemaker who serves a number of manufacturing plants in Chicago.

As in most such shops, his only means of trying out dies was a hand power screw press which sometimes needed six or seven men to get the needed pressure.

Large dies had to be tried out on his customers' production presses . . . which required drayage ($15 to $20 each way) and interruption of his customers' production. It meant both expense and nuisance to his customers and himself every time a die had to be tested.

Now he has ended the nuisance by installing the press shown above in his own shop. It not only saves time and money, but avoids the embarrassment of having workers in his customers' plants see and know that occasionally a die must be taken back for adjustment.

Specifications for DAKE single-acting and double-acting die tryout presses in eighteen electrically operated models are contained in Bulletin 330. Write today for your copy!

DAKE CORPORATION, 634 Seventh St., Grand Haven, Mich.

SEND TODAY FOR BULLETIN 330

DAKE CORPORATION
634 Seventh St., Grand Haven, Mich.
Please send me a copy of Dake Bulletin 330.
Name_____
Company_____
Address_____
City_____ Zone____ State_____

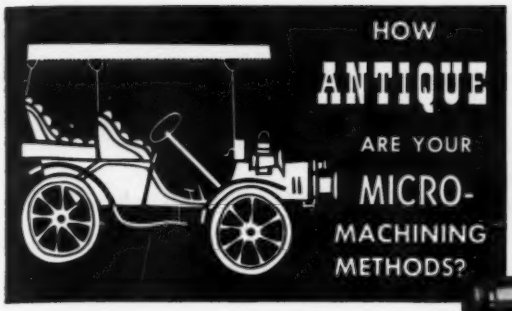
CIRCLE INFORM-A-GRAM KEY NO. 202

Speed Production Assembly with a new adjustable parts bin which is completely adaptable to any installation. The Speedbin can be arranged in a limitless number of designs. It varies with space limitations, size of parts and the number of operations performed by an individual worker. Details on the Speedbin are found in an illustrated folder made available by Speed Assembly Equipment Co., Box 344, Fords, N. J., or —
Circle Inform-A-Gram No. B61.

No Special Indicator Bases Are Needed with Surfcenters. These precision universal test centers can be set on a surface plate in vertical, horizontal or angular position. A bulletin points out the various features of Surfcenters. In addition, it has information on the Dialsink. Copies of the bulletin are made available by Inspection Devices Co., div'n of Corco Tool Co., 5417 S. Halsted, Chicago 9, or —
Circle Inform-A-Gram No. B62.

An Optical Torque Tester is the subject of a bulletin from P. A. Sturtevant Co., Addison, Ill. The three OTT models are listed and their features noted. They check torque wrenches in a horizontal plane rather than a vertical one. In addition, technical data is given on the optical torque testers. Also detailed are their specifications. For further information, see the bulletin issued by the company, or —
Circle Inform-A-Gram No. B63.

Ultrasonic Equipment for thickness testing, flaw detection and metal cleaning is featured in a catalog sheet from Branson Ultrasonic Corp., 37 Brown House Rd., Stamford, Conn. This equipment provides fast cleaning and degreasing, and non-destructive testing from one side of the metal or plastic. Each unit is shown, described and typical applications noted. For details, see the catalog sheet put out by the company, or —
Circle Inform-A-Gram No. B64.

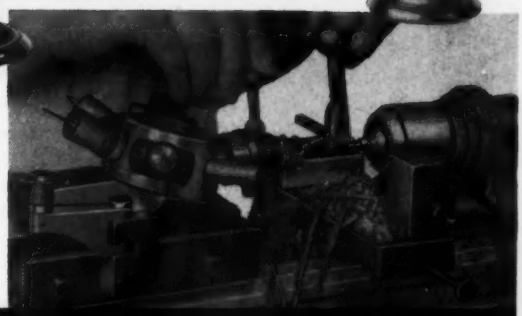


YOU CAN PRODUCE SMALL INSTRUMENT PARTS WITH MORE ACCURACY · ECONOMY and SPEED

LEVIN® TURRET LATHES

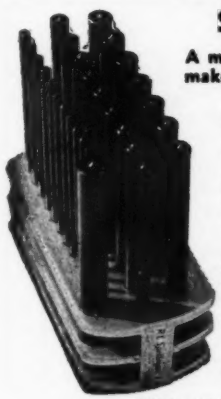
A small precision turret lathe for second operations and production of instrument parts. Available in two collet capacities, 5/16" or 3/16". The 6 position turret is self indexing and has hardened ways. Turret holes are 1/2" diameter. Turret travel 1-5/8". The cross slide has a swivel side at one end and a rigid tool block at the other. Lever collet closer provides quick opening and closing. A variety of turret tools with 1/2" shanks is available.

Send for catalog M describing complete line of instrument lathes, micro-drilling equipment and accessories.



LOUIS LEVIN & SON, INC.—3610 S. BROADWAY—LOS ANGELES 7, CALIFORNIA

CIRCLE INFORM-A-GRAM KEY NO. 2031



SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—Sizes 3/32" to ½" by 1/64" plus handy 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2032

HAND KNOBS

6 SIZES

CAST IRON

Tapped, Reamed or Blank.

Hex-shaped hub for extra tightening.

Write for catalog

TIETZMANN TOOL CORPORATION

Dept. HK-2 • Englewood, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2033

IT'S PLAIN TO see

A Boring Head That Won't Face is NOT Complete

NOW you can get a boring head that will BORE, FACE, TURN and GROOVE at no more cost than you would pay for a plain, single purpose boring head.

LOOK INTO THIS before you buy that new head. Write for full details.

CHANDLER TOOL CO.

Muncie, Indiana, U.S.A.

Chandler-Duplex

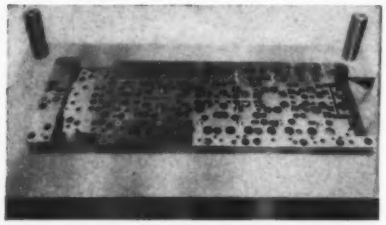
COMBINED BORING AND FACING TOOLHEADS

CIRCLE INFORM-A-GRAM KEY NO. 2034

Holes

JIG GROUND with *Vulcanaire*

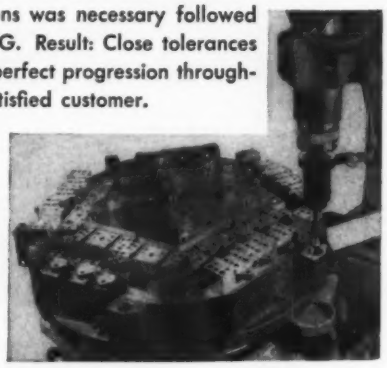
Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



41ST year of Vulcan service.

A seven station die from Vulcan's contract Tool Room. Standard sized punches and buttons were used. But since forming and piercing operations were involved hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

Borrow our instructive 11 minute movie on Jig Grinding.



A five station indexing fixture from Vulcan's contract Tool Room. Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts, and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

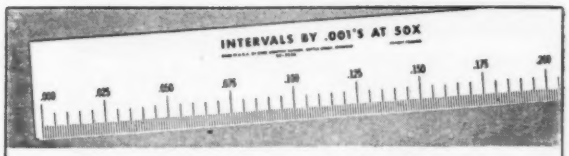
Services of YOUR TOOL ROOM in Dayton

Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

VULCAN TOOL CO.

741 LORAIN AVE. • DAYTON 10, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2041



Gage Company PRECISION PLASTIC

COMPARATOR SCALES

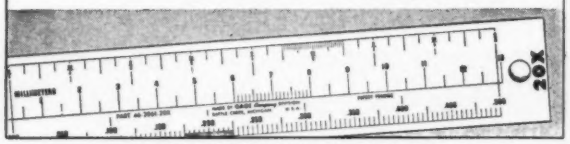
Non-breakable...accurate...designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

An unexcelled tool for use in drafting and constructing scale layouts for comparator chart use. All standard magnifications and various styles for every application.

WRITE FOR BULLETIN NO. 54-1511

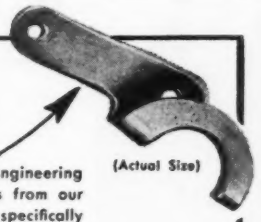
GAGE COMPANY

BATTLE CREEK, MICHIGAN



CIRCLE INFORM-A-GRAM KEY NO. 2042

SAVED— $696.00 or 90%



(Actual Size)

After consultation with our engineering staff and with the use of dies from our tremendous library maintained specifically to save our customers time and money, this part illustrated actually saved one manufacturer 90% of usual production costs!

Price breakdown was as follows:

Tools	$79.00
Labor	.059
Tapping	.016
Material	.0081

LOW die cost
FAST delivery

- Blanking
- Forming
- Piercing
- Drawing
- Extruding
- Stenciling
- Tapping
- Countersinking
- Plating
- Machining
- Painting
- Grinding
- Welding

Yes, WLS SPEEDTOOLING for small quantity stamping needs is a saver every time! A radical production advancement, it eliminates most of the cost required for permanent dies. Finished parts are produced to tolerances as close as those from tools costing ten times as much. When jobs are completed WLS SPEEDTOOLING is stored for future use.

Use WLS for production quantities up to 100,000 when low cost, fast delivery, possible design changes for virtually nothing, are important factors!

FREE

1. Write now for a free sample part with a cost summary.
2. Our free bulletin also illustrates 40 small stampings.
3. Send in your blueprints to our engineering department for a prompt quotation.

WLS STAMPING COMPANY

3283 E. 80th Street • Cleveland 4, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2043

Industrial Metals, Clad Metals, and solid and clad precious meals are produced and fabricated by Metals & Controls Corp., General Plate Div'n, Attleboro, Mass. Parts and assemblies are also produced from thermostat metals and electrical contacts. A booklet deals with each type of metal, showing typical types and illustrating typical applications. Copies of Booklet PR-700A are provided by the company, or —
Circle Inform-A-Gram No. B65.

Produce Superior Crankshaft Bearing Surfaces using new metallizing powder, Colmonoy C-250. A bulletin discusses its use, properties, and characteristics. In addition, it illustrates the essential steps in crankshaft preparation and application of the material. Also included is a detailed 11-step application procedure. Wall Colmonoy Corp., 19345 John R St., Detroit 3, will fill requests for Engineering Data Sheet 53, or —
Circle Inform-A-Gram No. B66.

Hydraulic Tracer-Control Duplicators are the subject of Bulletin 2771 from George Gorton Machine Co., Racine, Wis. The various models available are shown and described and the features detailed. In addition, the bulletin presents typical applications. Copies of the bulletin complete with specifications and dimensions are made available by the company, or — **Circle No. B67.**

A High Pressure Oil Gun System is the subject of Bulletin 681-A released by Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis 20, Mo. It is used for positive high pressure lubrication of all machine bearings requiring periodic applications of fluid lubricants. For details, features and specifications of the system, get a copy of the bulletin from the company, or — **Circle No. B68.**

Solderforms are highlighted in a bulletin prepared by Kester Solder Co., 4201 Wrightwood Ave., Chicago 39. Special shapes and standard types such as rings, discs, pellets, washers and springs are available. In addition to discussing the features of solderforms, the bulletin illustrates and describes a typical application. For copies of the bulletin, contact the company, or —
Circle Inform-A-Gram No. B69.

Specifications, Suggested Applications and Prices for the Shalo-Chek adjustable indicator gage are listed in a folder announced by Ellstrom Inc., 22038 Beech Rd., Dearborn 8, Mich. Covered are the three standard models available which are used for checking shallow dimensions ranging from 1/32" to 1/2" deep. For complete details, get the illustrated folder from the company, or —
Circle Inform-A-Gram No. B70.

Improve the Accuracy and Finish of Commercially Ground Parts with the Cincinnati Filmatic centerless lapping machine. Finishes within 1 to 2 micro-inches can be obtained and diameter tolerances of 0.00005" and 0.000025" are possible. A bulletin presents its design features and a brief description of the machine. Also listed are specifications and standard and special equipment. Copies of Publication G-683 are supplied by The Cincinnati Milling Machine Co., Cincinnati 9, O., or —
Circle Inofrm-A-Gram No. B71.

Materials Handling, Automatic Assembling, Inspecting and light machining operations are facilitated with Conveymatic Carrousel steel platen conveyors. They feature automatic indexing, adjustable dwell and controlled two-directional travel. A bulletin describes construction details, sizes, travel speeds, working heights, load capacities and a typical Conveymatic light-machining setup. For complete details, see Bulletin C-1056 from Visi-trol Engineering Co., 9345 Hubbell, Detroit 28, or —
Circle Inform-A-Gram No. B72.

Automatic feeding and setting with...

T-J

Speeds up riveting and clinching!

It's a quick step to *faster assembly* and *reduced labor costs* when you put T-J Rivitors and Clinchors in your production picture! These performance-proved machines are suited to a wide range of assembly jobs for aircraft, automotive, farm machinery riviting jobs of all kinds.

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to 7/8" long. Throat depths 8" to 36".

T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

Send today for these helpful references: Rivitor bulletins 646 and 555 . . . Clinchor bulletin 555. The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON

RIVETS 4 AT A TIME! Special quadruple riveting unit, incorporating two Model "RR" Twin Rivitors, mounted on a special welded steel base. Equipped with air-operated hold down mechanism and a safety air trip arrangement. Tooled for riveting left hand and right hand automotive muffler bracket assemblies.

SPECIAL TWIN RIVITOR! Tooled for 6 station indexing fixture, incorporating automatic clamping and ejecting mechanisms, for riveting laminated armature assemblies.

T-J CLINCHOR adaptable to a wide range of clinch nut setting problems. Gravity feed model shown here.

CIRCLE INFORM-A-GRAM KEY NO. 205

MEN YOU SHOULD KNOW

Morris L. Hutchens has been elected vice president in charge of engineering for Kearney & Trecker Corp. **Herbert Whitney** has taken over as chief metallurgist and **Charles Parske** as chief engineer of the general engineering department.

◆

Raymond E. Channock has become vice president and treasurer of The National Acme Co., succeeding **George J. Steinbicker** who has retired. Mr. Channock joined the firm in 1944.

Ben Idov has been appointed plant superintendent of the Housewares Division of the Baltimore plant of Proctor Electric Co. **Al Steinbach** has joined the company in Baltimore as plant superintendent of the Equipment Division.

◆

The appointment of **C. H. Collins** as plant engineer of the Pontiac Motor Division of General Motors Corp. has been disclosed. Mr. Collins succeeds **T. W. Bradford** who will be on special assignment.

J&L

TANGENT DIE HEADS
AUTOMATIC OPENING

Revolving . . . for multi-spindle automatics; drill presses; special machines

- Chasers can be changed in a few seconds without disturbing the die head or holders
- Positive, automatic tripping permits threading close-to-shoulder on every piece
- One set of holders handles a full range of coarse, fine and multiple threads

CLASS III THREADS GUARANTEED . . . EVERY TIME

For full information on J&L Thread Tool Products . . .

Automatic Opening Die Heads & Chasers
Automatic Opening Collapsible Taps
Solid Adjustable Taps
Automatic Opening Stud Setters
Modern-Magic Chucks & Collets
A Complete Line of Accessories

. . . send for this free book

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, 510 Clinton St., Springfield, Vt., U.S.A.

Class III Guaranteed Not Sometimes, but Everytime!

J&L THREAD TOOL DIV.

CIRCLE INFORM-A-GRAM KEY NO. 206

W. A. Henderson is the new general manager of United Saw & Tool Co., an affiliate of J. Lee Hackett Co. He formerly was coordinator of engineering for the new Twinsburg (Ohio) Stamping Division of Chrysler Corp.

◆

Louis Polk has been elected vice president, director, group executive and member of the administrative committee of Bendix Aviation Corp. His election follows the acquisition by Bendix of the business and assets of Sheffield Corp., of which Mr. Polk was chairman of the board and president.

◆

The new president of Pangborn Corp is **Victor F. Stine. Ralph M. Trent** has assumed the duties of a director and executive vice president and W. O. Vedder has been elected a vice president.

◆

William H. Uren has been appointed operations manager of Sahlin Engineering Co., Inc.

◆

Three executive promotions have been announced by Crane Packing Co. **Carl E. Schmitz** is now serving as executive vice president, **Vance E. Vorhees** as vice president in charge of sales, and **B. H. Stenberg** as vice president in charge of manufacturing.

◆

Warren G. Qualls has been promoted to superintendent at the Greenville plant of Temco Aircraft Corp.

◆

J. D. Kennedy is the new manager of the industrial diamond section of the Metallurgical Products Department of General Electric Co. He succeeds **J. S. Gillespie** who was recently named manager of engineering.

◆

Appointment of **J. F. Weiffenbach** as director of research and engineering for Borg-Warner Corp. has been disclosed.

◆

Russell P. Scholl has been promoted to manager of the gage section of the Bryant Gage & Spindle Division, Bryant Chucking Grinder Co. **Hessler Gates, Jr.** has been named chief of engineering and production for the section.

L. A. Young Spring & Wire Corp. has made known the appointment of **Don Cannon** as manager of its three Chicago plants.

◆

J. F. Forster has taken over as executive vice president of Vickers Inc. He will have direct charge of all Vickers operations. Mr. Forster joined the company in 1941.

Firth Sterling Inc. has disclosed the promotion of **Kenneth E. Mcknown** to product manager, Class I

MEN YOU SHOULD KNOW

steel products and special shapes. In addition, he will retain his position as superintendent of the Tool Bit Department.

Harry D. Hall has been named director of the Process Development Section at the Technical Center of General Motors Corp. He succeeds **Glenn R. Fitzgerald** who has been made chief engineer, automotive products, of the AC Spark Plug Division. Mr. Hall joined the company in 1939.

◆

Kenneth C. Butterfield has become staff master mechanic for Chrysler Corp., succeeding **C. F. Vanderkerck** who has been named to the general manager's staff of the company's Stamping Division. Mr. Butterfield will be responsible for the administration of the central master mechanic department and will provide technical guidance for master mechanic activities throughout the corporation.

◆

North American Aviation, Inc. has appointed **Harrison A. Storms, Jr.** as chief engineer of the Los Angeles Division. He fills the position left vacant by the retirement of **C. J. Hansen.** Mr. Storms has worked for the company as an engineer since 1941.

◆

Two new executive appointments have been announced by **Steven P. J. Wood,** president of Warner Electric Brake & Clutch Co. **Norman K. Anderson** has been named vice president and general manager of the Warner Industrial Division. **King DeSeve** has become vice president and general manager of the Warner Automotive Division.

◆

The Denison Engineering Division of American Brake Shoe Co. has named **Paul W. Norris** vice president and general manager. He has over 23 years service with Denison.

◆

Richard J. Keyser is serving as consultant-shop operations for the manufacturing operations service of General Electric Co. In his new capacity, Mr. Keyser is doing research and development work in the field of organization for factory or shop operations with special emphasis on the scope of the foreman's job. He is also assisting operating managements to develop more efficient shop operation organizations.

Charles H. Zweifel is serving as chief engineer of Pacific Coast Engineering Co.

◆

F. W. Dorenbos has become assistant chief engineer for Clearing Machine Corp., division of U. S. Industries, Inc.

◆

Alphe G. Jarreau has been named vice president of The Barden Corp. The announcement was made by **J. Robert Tomlinson,** president.

◆

Donald Parks has become chief engineer for Micrometrical Mfg. Co.

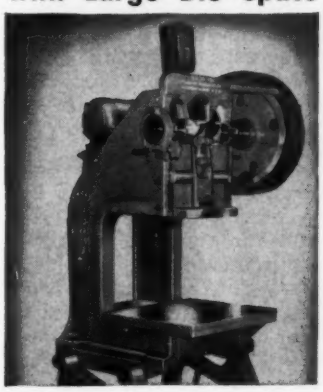
Manuel F. Diaz is the new president of Wesson Tool Co. He replaces **Ernest Mortensen** who recently retired after 50 years in the cutting tool industry.

◆

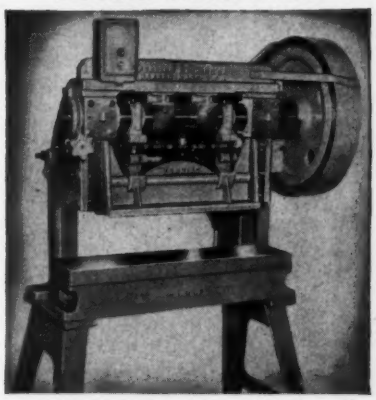
Verson Allsteel Press Co. has announced the appointment of **Melvin D. Verson** as vice president-marketing. **William O. Gallery** has moved into the position of vice president-administration. Before joining Verson he had spent 35 years in the U. S. Navy.

"Little" Presses... BIG Performance!

Perkins Deep Throat Press with Large Die Space



Perkins Model A Light Capacity Double Crank Press



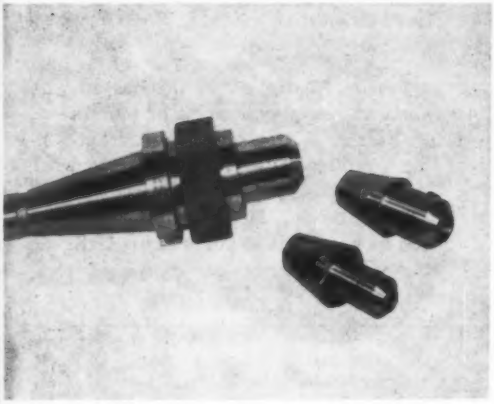
IF . . you want to save space and the cost of a BIG press, these Perkins all-purpose presses with 10 ton capacity are the answer! Available with air clutch or pin clutch. Variety of strokes and heights. Can be furnished with Feed Rolls, Front-to-back Feeding or Left-to-right Feeding. Write for complete details about these "little" presses with BIG production capacities.

PERKINS
MACHINE CO. WARREN, MASS.
PRESS BUILDERS FOR OVER 50 YEARS

CIRCLE INFORM-A-GRAM KEY NO. 207

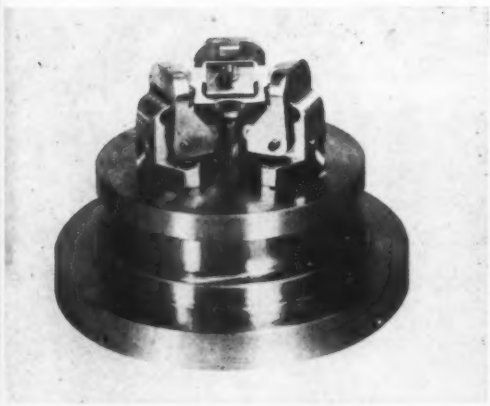
PRODUCTS

NEW DEVELOPMENTS · IMPROVEMENTS · COST AND TIME SAVERS



TOOL HOLDERS . . .

Kwiklok quick change holders are used on boring mills, jig borers, milling machines, radials and turret lathes. The Kwiklok holder is shown with an end mill adapter and along with it are two other interchangeable adapters to accommodate different size end mills. Falcon Tool Co., P.O. Box 4605, Detroit 34, or — **Inform-A-Gram No. A1.**

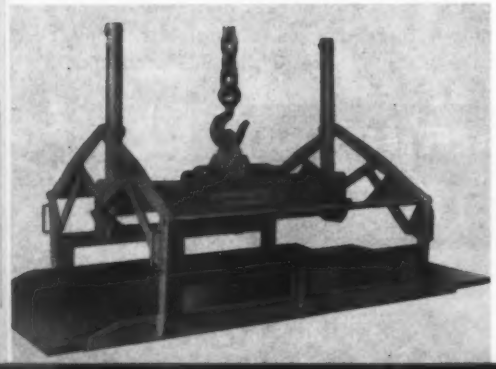


GEAR CHUCK . . .

An exclusive rotating ball locator pin is a feature of the bevel gear chuck developed by Splinemaster Products Co., 6781 Maxwell, Van Dyke, Mich. It can be converted from one gear size to another by repositioning the pin holding blocks. This bevel gear chuck is designed to reduce costs and time, and increase quality. **Inform-A-Gram No. A2.**

POWER SAW . . .

Model C-12 power saw with a work capacity of 12″ x 12″ in size and 1500 lbs in weight, handles miscellaneous cutoff work. Accuracy of cut is 0.002″/in of dia. The low-priced, heavy-duty power saw is used in tool and die, and general machine shops and the maintenance departments of large plants. The DoAll Co., Des Plaines, Ill., or— **Inform-A-Gram No. A3.**

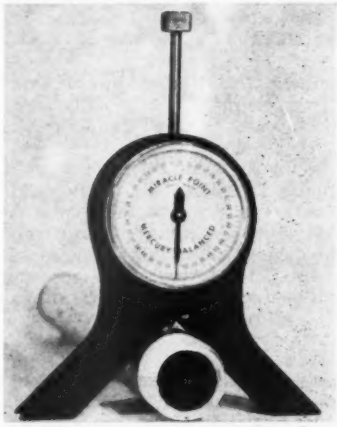


SHEET LIFTER . . .

The arms of this motorized sheet lifter move in and out in a straight line, rather than in an arc. There is no need for manual adjustments when changing from one size sheet to another. Heppenstall Co., New Brighton, Pa., or — **Inform-A-Gram No. A4.**

CENTERING HEAD . . .

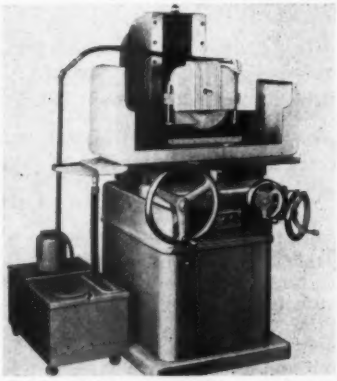
A new magnetized centering head and level has been introduced by Brite-Line Corp., 3387 Brownlow Ave., Minneapolis. Instantly read, this unit speeds leveling, locating center points



and finding precise angles for a wide variety of applications. The Miracle Point indicator also facilitates setting metal frames; milling, grinding and shaping work; and installing pipe. A built-in center punch marks the points in layout. **Inform-A-Gram No. A5.**

SURFACE GRINDER . . .

Large capacity at low cost is offered by No. 17 hand feed surface grinder that is particularly suited for die block and general toolroom work. The table is actuated by a timing belt drive



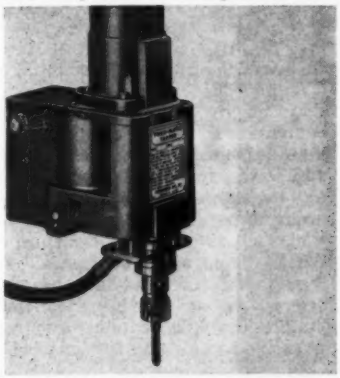
which eliminates the rack and pinion. Setup time and operating effort are reduced and accuracy increased. For details, see Bulletin 739 supplied by Covel Mfg. Co., Benton Harbor, Mich., or — **Inform-A-Gram A6.**

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

PNEUMATIC TAPPER . . .

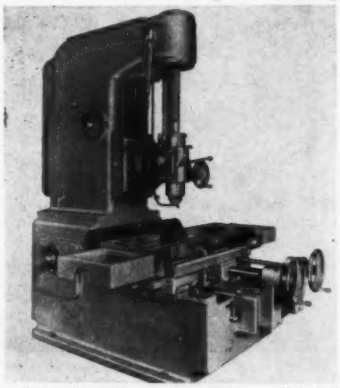
Designed for production, general purpose or extreme precision tapping is this automatic, high speed air-actuated tapping head with adjustable torque control.



The Pneu-Matic tapper can be mounted on any drill press. It handles a wide range of taps from No. 0 to ¾-16. Automatic control of rapid approach, tapping, reversal and withdrawal permits high speed automatic or semi-automatic tapping. Commander Mfg. Co., 4225 W. Kinzie St., Chicago, or —
Circle Inform-A-Gram No. A7.

BORING AND MILLING MACHINE . . .

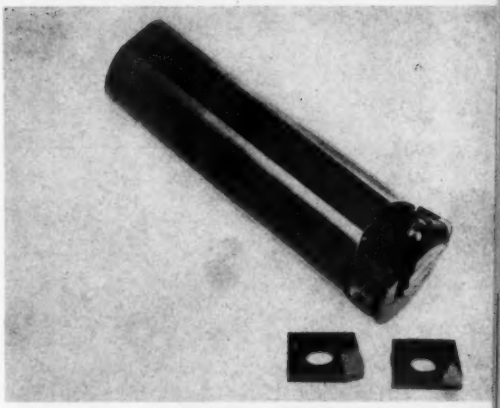
This extremely versatile, fast and accurate vertical machine is used for precision boring and milling. No. 60 is built in two sizes with a 30" vertical capacity on both. It features quick change



tooling for the spindles, and table and saddle locating counters. W. B. Knight Machinery Co., Vandeventer & W. Pine Blvds., St. Louis 8, Mo., will supply details on No. 60, or — **Circle No. A8.**

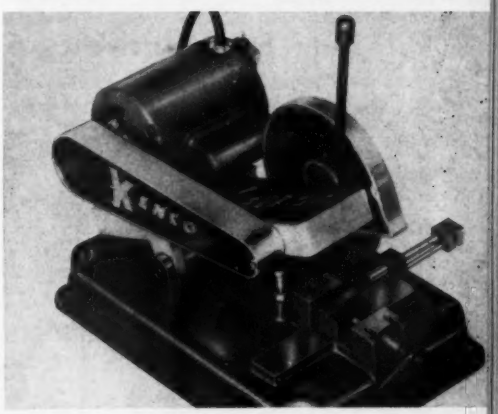
BORING BARS . . .

Interchangeable anvils make the micro-adjustable boring bars completely transferable from a turning to a threading or facing operation or from one needing triangular inserts to another with round or square throw-aways. Tool grinding is eliminated. Weschine downtime cut. Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich., or — **Circle A9.**



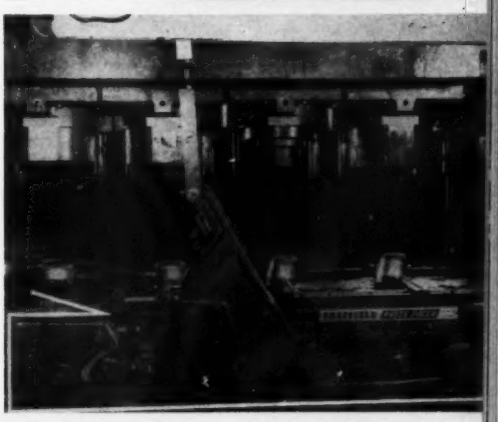
CUTOFF SAW . . .

Eliminate tying up milling machines for cutoff production by using a low-cost cutoff saw. It can be set up for any run, including changeover from ferrous to non-ferrous metals, in only 1½ min. Full details are found in literature supplied by Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles 22, or —
Inform-A-Gram No. A10.



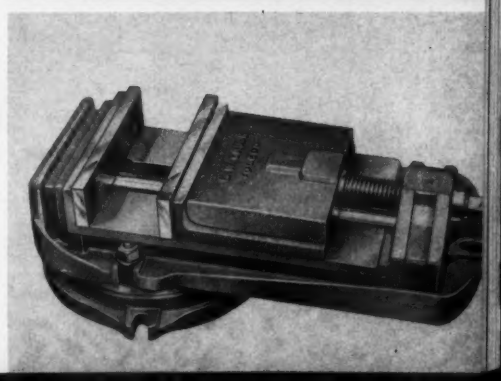
TRANSFER UNIT . . .

Automate any standard long-bed press with the Press Pacer. This portable unit transfers stampings from one die station to the next on each stroke of the ram. It can also be used to transfer parts between presses. The Press Pacer enables one press to do the work of several. The Sheffield Corp., Dayton 1, O., will supply details, or —
Inform-A-Gram No. A11.



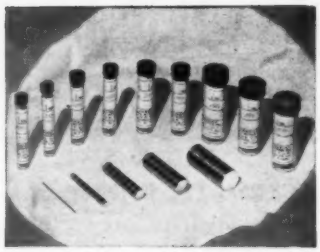
VISE . . .

A newly designed line of extra strong swivel base milling machine, drill press and shaper vises has been announced by L-W Chuck Co., 72 S. St. Clair, Toledo 4, O. Three sizes are available. All surfaces are ground for extreme accuracy.
Inform-A-Gram No. A12.



For Use in Miniaturized Equipment are the Mini-Mite Nos. 0, 1, 2, and 3 set screws. They are available in socket, socket cap and slotted styles and a variety of points, and in certain specified lengths, threaded lengths and special materials. Set Screw & Mfg. Co., Bartlett, Ill., or —
Circle Inform-A-Gram No. A13.

A New Low-Cost Line of reversible-pin plug gages has been produced by Dundick Tool Works, Inc., 3410 W. 31st St., Chicago 23. The Deluxe Line is made in all sizes from 0.030" to 0.750" in increments of 0.001" with tolerances of ±0.00005", to be purchased individually or in sets.
Circle Inform-A-Gram No. A14.



How to Cut the Cost of Gaging Threads

with TAFT-PEIRCE JOB-RATED GAGES

The *best* gage for most jobs provides the *best* combination of speed, wear-resistance, upkeep, and initial cost. Here are some comparisons that will help you keep costs to a minimum.

Thread Plugs

T-P Limit Thread Plug Gage. Standard hardened steel gages are lowest in initial cost and are preferable when soft or moderately hard materials are being inspected in limited quantities. Taper-Lock up to 1.510". Reversible from 20 to ½". Reversible Tri-Lock above 1.510"

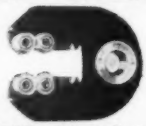
T-P Electrolized Gages. With only a modest increase in initial cost, substantially longer wear life can be obtained with this exclusive surface treatment. Many users report up to 3 times longer gage life.

T-P Carbide Thread Plug Gage. For exceptional resistance to abrasion or scratching and maximum wear life. Furnished in both standard and special sizes — from 28 machine screw size up.

Rings & Snaps

T-P Thread Ring Gages. Lower in initial cost than other gages for external threads, they check a combination of all thread errors but cannot distinguish between them.

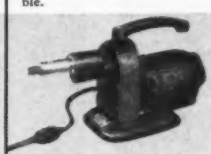
T-P Adjustable Thread Snaps. Faster than ring gaging, and just as accurate, they check lead, angle, and all other thread elements. Pitch diameter is variable.



T-P Roll Thread Snaps. Same as adjustable, with *rolls* for gaging members. Since gaging members rotate, wear is spread over greater surface and service life increased.

Special Gages

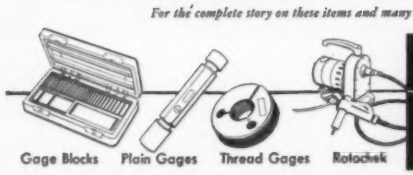
T-P Rotochek (Flexible Shaft Model). Fastest thread gaging method yet devised. Push—and the gage screws into the work. Release the pressure and it stops. Pull—and it disengages. Can be used with most standard T-P plug or ring gages.



T-P Rotochek (Bench Model). Permits bringing work to gage, instead of gage to work. Like flexible shaft model, records indicate it triples rate of parts inspection.

T-P Thread Concentricity Gage. Typical of the infinite variety of special gages made to order by T-P every year. This one checks size and location of internal threads.

For the complete story on these items and many more, send for your copy of the Taft-Peirce Handbook.



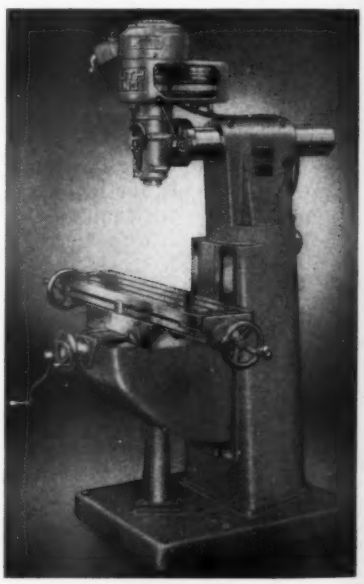
T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 210

New Oil and Air Hardening Flat Ground Die Steel has been announced by Heller Tool Co., Newcomerstown, O. The complete line includes more than 1300 standard stock sizes for a wide variety of tool and die applications. The oil hardening type is used for toolmaking jobs such as dies, jigs, punches, templates, gages and small tools. Tools made from the air hardening type are suited to punching silicon or stainless steels, Monel and other abrasive metals and for long production runs where the tool is used without frequent sharpening.
Circle Inform-A-Gram No. A15.

A Wide Variety of Exacting Toolroom and Production Work can be handled by a new vertical spindle milling machine. The table is 9" wide and is available in 32" or 42"



length with 20" or 30" longitudinal travel, 9½" cross-feed and 18" vertical feed. South Bend Lathe Works, South Bend 22, Ind., or —
Circle Inform-A-Gram No. A16.

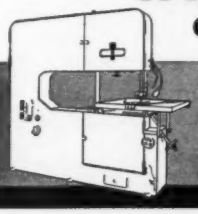
FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

FASTEST, BEST MEANS OF CUTTING METALS

If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

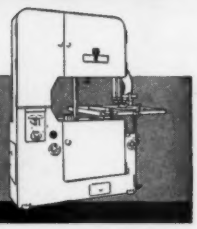
THE TANNEWITZ WORKS

GRAND RAPIDS, MICHIGAN ☎ **GL-6-1729**



TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES for CONTOUR SAWING, FILING, POLISHING

The smoothest, fastest, most trouble-free Di-Saws on the market. Write for bulletin.



CIRCLE INFORM-A-GRAM KEY NO. 2111

For DRILLING, CORE DRILLING, ROUGH and FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work — or both.

Eliminates expensive tool construction — Reduces tool wear — Prevents seizure and pilot breakage — Especially adapted where precision is required.

Write for full information and prices

GATCO ROTARY BUSHING CO.

42322 ANN ARBOR RD., U. S. 12, PLYMOUTH, MICH.
Telephone PLYMOUTH 1472

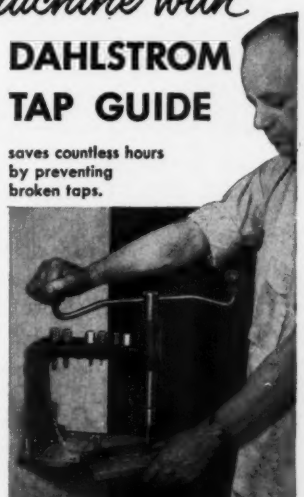
CIRCLE INFORM-A-GRAM KEY NO. 2112

Precision Tapping

by hand or machine with

DAHLSTROM TAP GUIDE

saves countless hours by preventing broken taps.



A low-cost Dahlstrom Tap Guide provides the accuracy and close tolerances of larger machines costing many times as much. Tap breakage, a major expense in many shops, is virtually eliminated with a Dahlstrom Tap Guide because metal material is always held straight and square. Light enough for portability, yet it can be bolted to wall or post for permanent installation.

Machine Tapping

The spindle top is centerbored to fit the tail stock of a lathe. Simply pull out for lathe use. The same spindle can also be used as a tap extension for reaching hard-to-get-at places. Tap Guide is furnished with nine adaptor sizes: 8-32; 10-24; ¼", 5/16", ⅜", 7/16", ½", 9/16", and ¾". *Write for bulletin.*

$59.50 F. O. B. Factory

BRANCH MFG. CO.
16 Olson Drive, North Branch, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 2113

DRILL FINISHED* HOLES

IN ONE *HIGH-SPEED* OPERATION

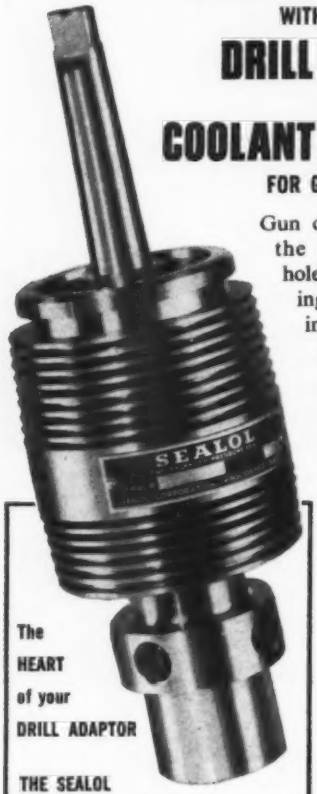
WITH SEALOL'S

DRILL ADAPTOR

AND

COOLANT SUPPLY UNIT

FOR GUN-DRILLING



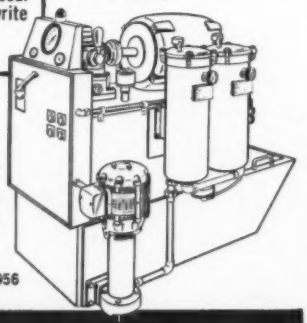
The HEART of your DRILL ADAPTOR

THE SEALOL Mechanical Seal provides positive protection against leakage along a rotating shaft. Widely used in aviation, process, oil and other industries. For specific seal application in your business, write Sealol today!

Gun drilling has revolutionized the production of accurate holes. For example, gun drilling saved $12,674.52 in drilling three shallow holes in each of 342 breech rings at the Watervliet Arsenal. Manufacturing methods engineers say that production time was cut by 71%!**

Your plant can save substantially and increase production by adapting your present drilling equipment for gun drilling with Sealol's Drill Adaptor and Coolant Supply Unit.

SEALOL DRILL ADAPTOR — transfers coolants from a stationary source to the rotating gun drill at speeds to 10,000 RPM — pressures to 1,000 PSI. Coolant is delivered through gun drill directly to cutting edge. Work runs cool, chips are flushed out continuously.



SEALOL HI-PRESSURE COOLANT SUPPLY UNIT — filters, cools and pumps coolant at pressures to 1,000 PSI — volume to 40 GPM (higher capacities available) for precision drilling of all types.

*to Gun Drill Tolerances
**American Machinist — Aug. 13, 1956

SEALOL CORP

DEPT. L, WARWICK INDUSTRIAL PARK, PROVIDENCE 5, R. I.

Please send me Bulletin information on Sealol gun drilling equipment.

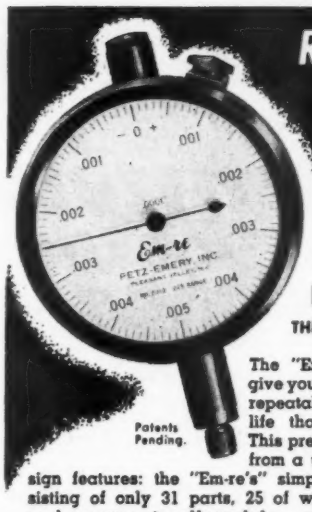
NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

CIRCLE INFORM-A-GRAM KEY NO. 2121



Patents Pending.

REPEATED ACCURACY

WITH

Em-re DIAL INDICATORS

THE MOST ACCURATE MADE

The "Em-re" Dial Indicator will give you greater accuracy, greater repeatability and longer service-life than ever before possible. This precision performance results from a unique combination of design features: the "Em-re's" simple, unit construction consisting of only 31 parts, 25 of which are interchangeable and common to all models — a fully jeweled gearing mechanism — and a completely shockproof system, throughout the *entire* range, that *actually contributes* to the measuring accuracy obtained. Rigid testing with millions of severe impacts has failed to impair even slightly this repeated accuracy (to better than .00002" in .00005" and .0001" indicators). Stocked in 26 models, 8 ranges from .002" to 1.000"; graduations in .00005", .0001", .00025", .0005" and .001". *Also available for accurate indicator testing — The "Master" Dial Indicator Checker.*

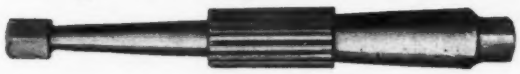
Write for Catalog E.

PETZ-EMERY INC.

PLEASANT VALLEY, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 2122

Expanding Mandrels



Accuracy 001" - No Distortion

No Slipping - Everlasting

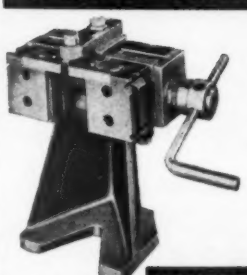
K. O. LEE CO.

ABERDEEN, SOUTH DAKOTA

If it's made by **Lee** *it's a* **"Knock-Out"**

CIRCLE INFORM-A-GRAM KEY NO. 2123

SPEED UP DRILLING & TAPPING JOBS!



JOHN'S DRILL JIG

For cross or end drilling round, hexagon, or square stock or standard or odd-shaped rough castings from 1/8" to 8" O.D. Will cut tooling and production costs to minimum—10 to 100,000 pieces.

Standard removable slip fit bushings and holders available to drill center or mean off-center. The self-centering action will hold within .0015" or better regardless of jig wear or piece part O.D. variation. Jigs available in three sizes 6", 8", 14"; jaw openings 2", 3¼", 7½".

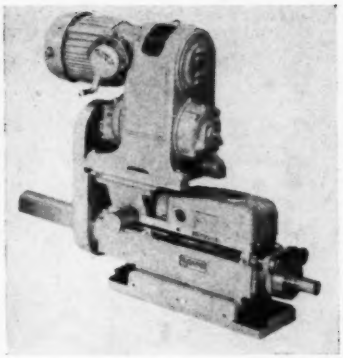
Write for complete information.

HEUSER MANUFACTURING CO.

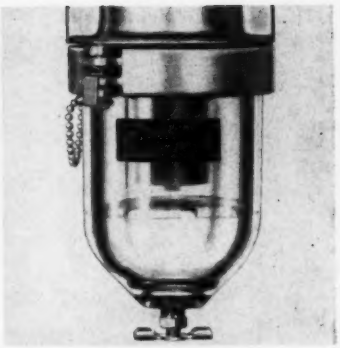
1642 N. PAULINA ST., CHICAGO 22, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 2124

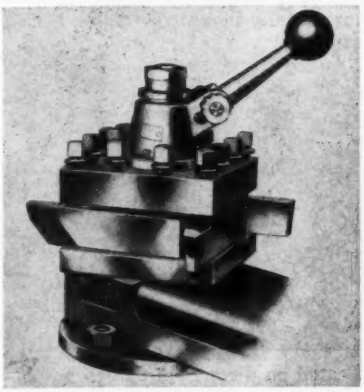
Air-Oil-Matic Drill Units are now equipped for automatic gun drilling. They are used for drilling deep holes 5/32" dia and up, and shallow holes where straightness, size and finish are critical. Morris Machine Tool Co., 933-38 Harriet St., Cincinnati 3, O., or —
Circle No. A17.



Moisture Removal Efficiency has been stepped up in redesigned Series 30AE compressed air filters now available from C. A. Norgren Co., Englewood, Colo. They increase the life of air operated equipment, improve operating efficiency, and reduce maintenance costs.
Circle No. A20.

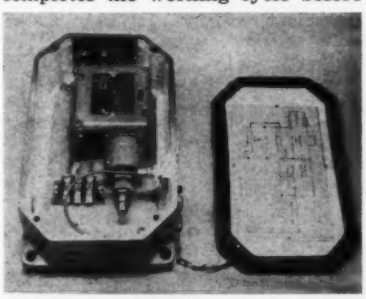


Positive Locking is assured with the new clamping type handle for turret tool posts produced by McCrosky Tool Corp., Meadville, Pa. This locking action enables the turret to withstand vibration even when



handling interrupted cuts, or the fast speeds and feeds of heavy duty production lathes. Turrets with the improved clamping type handle are available in three styles and 11 different sizes. **Inform-A-Gram No. A18.**

Protection against Lubrication Pressure Failure is provided by the Cyclesafe package unit. It automatically stops machinery when the lubrication pressure drops below a predetermined setting. The machinery completes the working cycle before



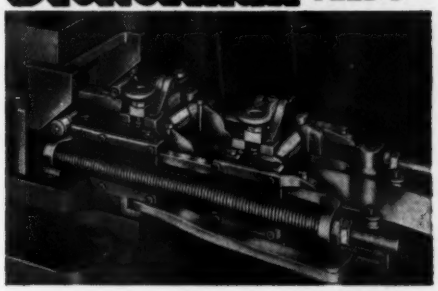
stopping, eliminating tool, cutter, die or knife damage or breakage. The Cyclesafe unit is easily mounted and can be applied to any type of machinery. Seneca Falls Machine Co., Seneca Falls, N. Y., or —
Circle Inform-A-Gram No. A19.

THE BOSS... gains through automation—overall production economy that means more work per day, per dollar.

8 ways to benefit... save... with

Dickerman FEEDS

PRESS ROOM FOREMAN... benefits by speed—Dickerman feeds operate continuously at any speed the tooling in the press will withstand.



PRESS OPERATOR... welcomes simplified operation—Dickerman feeds prevent human fatigue, human error, work indefinitely without downtime.

QUALITY CONTROL MEN... cheer the constant accuracy and uniformity Dickerman feeds bring to any press feeding job.

ASSEMBLY FOREMAN... gains as components flow in steadily—there's never an afternoon letdown, never a production lag.

THE CUSTOMER... is always ahead because deliveries are always on time, always "as specified".

DIE DESIGNERS praise the Dickerman templates that help them engineer Dickerman feeds onto their presses—send for your copies today!

You'll benefit through increased production . . . greater accuracy . . . bigger profits when you install dependable Dickerman Die Feeds, Hitch Feeds®, and Rol-Di-Feeds on your presses.

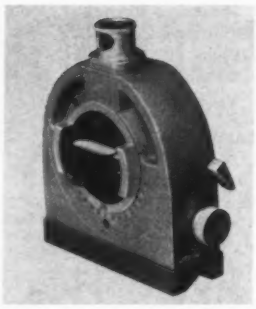
Dickerman

H. E. DICKERMAN MFG. CO.
321-304 Albany Street, Springfield, Mass.

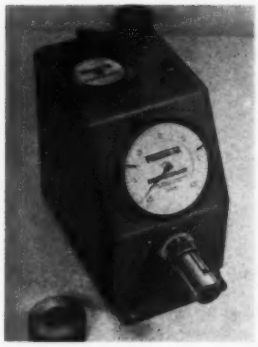
Send today for complete details on the money-making Dickerman line.

CIRCLE INFORM-A-GRAM KEY NO. 213

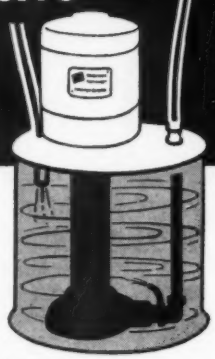
This Light-Weight Leitz Precision Clinometer has been introduced by Opto-Metric Tools, Inc., 137 Varick St., New York 13. It is used for checking the inclination of machine elements to a level plane or to each other. It is also used in obtaining surface flatness during machining operations. The base is permanently magnetized to make the instrument self-clamping in inclined positions.
Circle Inform-A-Gram No. A21.



An Improved Model of the Dimensionair air gage has been announced by Federal Products Corp., 1144 Eddy St., Providence 1, R. I. Model DA-1-R1 Series features a smaller regulator, more positive zero adjustment, and an efficient filter with transparent cup mounted on the gage itself.
Inform-A-Gram No. A22.



GRAYMILLS *Superflo*
PUMPS CIRCULATE
Carbide-Cutting Abrasive
Slurry Day In···Day Out
NO TROUBLE



YOU GET THE SAME ABRASIVE PROOF CONSTRUCTION WITH BALANCED FLOATING IMPELLER DESIGN WHEN YOU SPECIFY GRAYMILLS PUMPS FOR YOUR MACHINES

Thousands of Graymills Superflo Pumps are in continuous use, pumping abrasive slurries, ground glass, lens polishing rouge, enamels, lacquers and degreasing solvents.

They stand up because they're built for most tortuous applications. They resist wear and binding because the impeller floats on a cushion of liquid—no metal to metal contact, no seals, no packing.

Compared to such jobs as these, pumping coolants is a cinch. You can count on smooth, quiet performance—abundant volume—long life. They're DEPENDABLE!

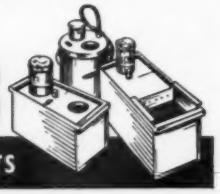
Sold by leading Industrial Distributors everywhere. Graymills representatives near you are ready to help with special problems.

Graymills Corporation, 3713 N. Lincoln Ave., Chicago 13, Ill. 142

WRITE FOR THIS NEW CATALOG

showing standard and JIC model centrifugal and gear type 1/25 to ¾ H.P. Pumps, Pumping Units, Accessories and helpful selection chart.

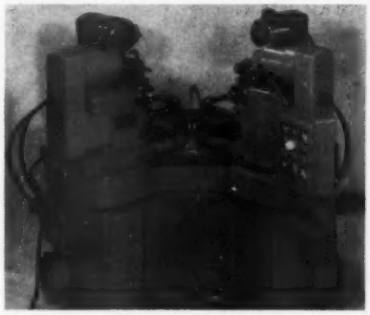
GRAYMILLS



Superflo COOLANT PUMPS AND UNITS

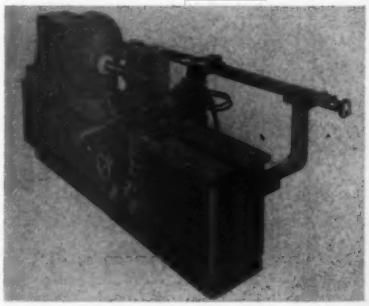
CIRCLE INFORM-A-GRAM KEY NO. 214

Varied Multiple Operations are performed by a special automatic cross-drilling machine designed by Russell T. Gilman, Inc., Grafton, Wis. The operations are handled by four horizontally-mounted drill heads,

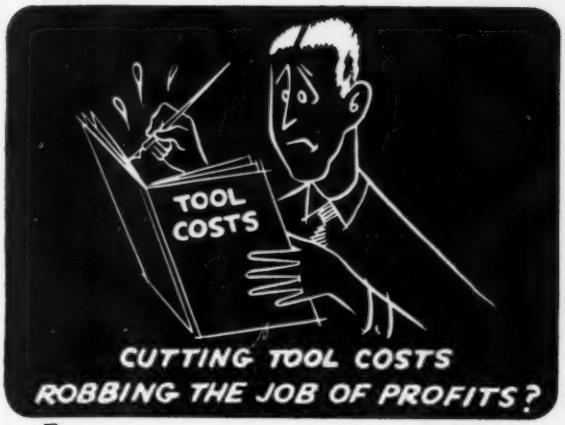


located on a common plane and pivoting around the axis of the workpiece through an arc of 270°. Feed movements are hydraulic-powered. Control of the four heads is interlocked to prevent drill interference.
Circle Inform-A-Gram No. A23.

Automatically Grind Intricate Contours, both internal and external, on a hydraulic tracer controlled contour grinder. A variable speed work head also makes polishing and buffing possible. Standard flat grinding wheels



are used by dressing them to the radius of the template in use. Details on the grinder are found in literature supplied by Industrial Tool Engineering Co., Detroit, or —
Circle Inform-A-Gram No. A24.



Systematic "NTS" salvage is the best way to cut cutting tool costs

Stop before you discard a worn or damaged cutter. It may be worth many times its scrap value!

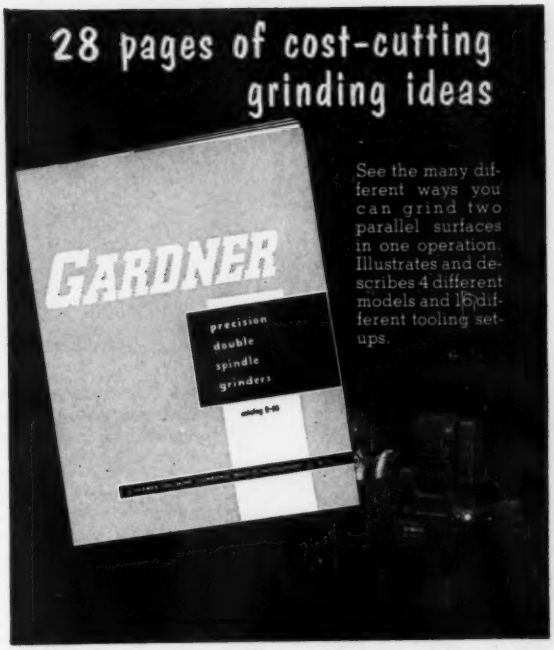
Since 1912 we have been restoring all kinds of cutting tools to new usefulness to help shops control their cutter costs.

Can we assist you in studying your operations and tool usage to determine if a salvage program will save money in your plant? There is no obligation.

Write for this catalog and the salvage story.

NATIONAL TOOL SALVAGE CO.
6511 EPWORTH BOULEVARD DETROIT 10 MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2151

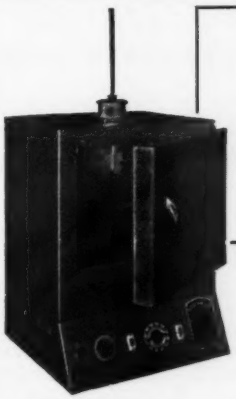

28 pages of cost-cutting grinding ideas
GARDNER
precision double spindle grinders
See the many different ways you can grind two parallel surfaces in one operation. Illustrates and describes 4 different models and 16 different tooling set-ups.

Send for your free Catalog D-53

GARDNER MACHINE COMPANY
416 Gardner St., Beloit, Wisconsin

137Mm

CIRCLE INFORM-A-GRAM KEY NO. 2152



HUPPERT KH 1200 LABORATORY OVEN

UNDERWRITERS' LABORATORY APPROVED MODEL

$100.00
Complete with thermostatic control and heat range switch

All Stainless Steel
$130.00
(Thermometer $5.00 extra)

Equalized oven heat at all times

Results from Huppert Ovens Are Always Accurate. Thermostatic control accuracy ½ of 1° C. at any setting up to 425° F.—220° C. This is achieved by a double venting system for constant dispersion of fumes and other exhaust air, permitting a cleaner operation and better distribution of heat. Work chamber is stainless steel 12" x 10" x 10".

HUPPERT 5700 SERIES OVEN
with 3-way Heat Range Switch

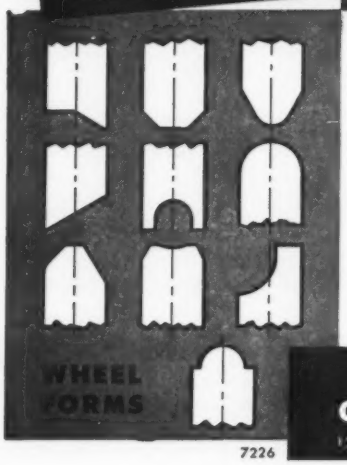
I. D. Wide	I. D. High	I. D. Deep	Wattage	Temp. Range	Price
20"	15"	19"	Max. 2250	130°F. to 550°F.	$190.00

20-hour electric timer—$18.00 additional
Write for literature

K. H. HUPPERT COMPANY
6820 Cottage Grove Avenue, Chicago 37, Illinois
Manufacturers of Electric Furnaces and Ovens

CIRCLE INFORM-A-GRAM KEY NO. 2153

Precision Dress Grinding Wheels to ANY FORM IN ¼ THE USUAL TIME



The Perfex TANGI-MATIC Dresser is a self-contained precision tool built by an organization of master gagemakers for high precision work.

Any shop man who can read a "mike" can operate the dresser the first time. No Jo Blocks, no height gages or other auxiliary tools needed. All radii and angles are read directly.

Write for Descriptive Bulletin

PERFEX

PERFEX
GAGE & TOOL CO.
123 AVERY ST. • MT. CLEMENS, MICH.

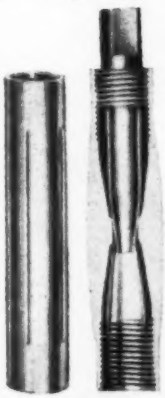
7226

CIRCLE INFORM-A-GRAM KEY NO. 2161

Flexolap.. INSTANTLY AND ACCURATELY ADJUSTABLE FOR FAST LAPPING AND POLISHING

. . . without danger of galling or seizing!

The Flexolap barrel is made with a series of longitudinal slots milled "off-center" to permit sensitively flexible expansion up to 15% — or more — under pressure of the adjusting pin. This construction enables Flexolap to save valuable time and to lap rounder, straighter holes. For accurate precision take-up, as desired, to maintain size and compensate for wear on barrel . . . simply turn adjustment screw.



Illustrated at left is Flexolap Set No. 1. Includes 6 complete laps, one of each size (3/16", 1/4", 5/16", 3/8", 7/16" and 1/2"), and one additional brass barrel of each size, all held on a sturdy, serviceable stand. Price complete $14.00

Also available in sizes 7/32", 9/32", 11/32", 13/32", 15/32", 9/16", 5/8", 11/16" and 3/4". For lapping holes smaller than 3/16", use the Midget Lap. Seventeen sizes: .032, .036, .040, .046, .054, .062, .070, .079, .090, .104, .120, .135, .155, .170, .187, .218, and .250. Trial assortment (17 laps) $2.10

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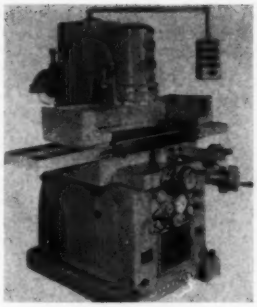
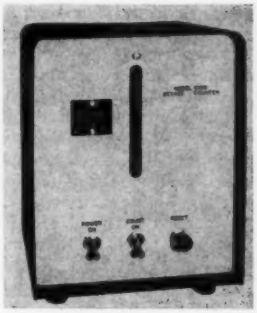
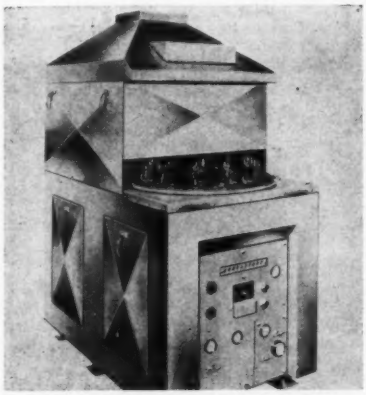
Horizontal, Vertical and Multi-Angle Grinding are performed by the Zocca surface grinder with a swivelling column which rotates 180°. It is made in table sizes ranging from 12" to 48" wide and 24" to 360" long. This multi-purpose grinder can be used for all variations of die, toolroom and production grinding. S & S Machinery Co., 140 - 53rd St., Brooklyn 32, N. Y., or — **Inform-A-Gram No. A25.**



Counting Rates Up To 12,000 Counts/Min are possible with a portable electronic counter. It features a combination of plug-in electronic decade and five-digit mechanical register. It is suited for a wide variety of testing and measurement applications. Performance Measurements Co., 15301 W. McNichols Rd., Detroit 35, or — **Circle No. A28.**



An Automatic Soldering Machine has been developed by Castle Machines, Inc., Erie, Pa. The Braze-O-Matic is used for feeding solder through magazines to pre-heated parts for solder fabrication. With



this machine, high quality soldering is possible at a greatly increased production rate. It works equally well with all known forms of soldering and all types of metals.
Circle Inform-A-Gram No. A26.

A Hand Portable Industrial Arc Welder of 200 Amp Output has been manufactured. Weighing 80 lbs, Model 200B employs a Transoidal transformer which enables it to perform the work of a conventional arc

welder four to five times its size and weighing three times as much. It is equipped with a thermal overload switch to prevent transformer burnout. Brennen, Bucci & Weber, Inc., 262 Mott St., New York 12, or — **Circle Inform-A-Gram No. A27.**

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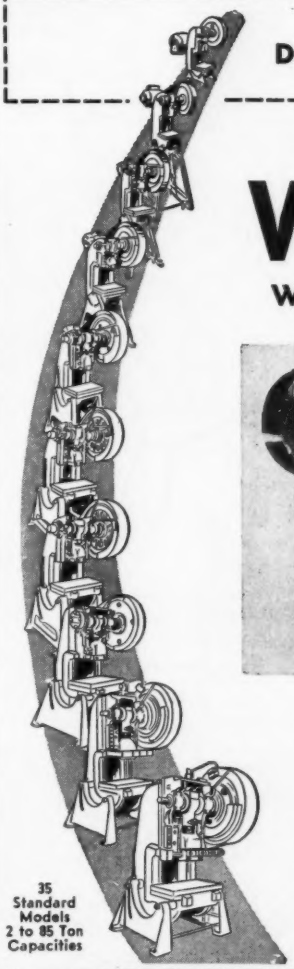
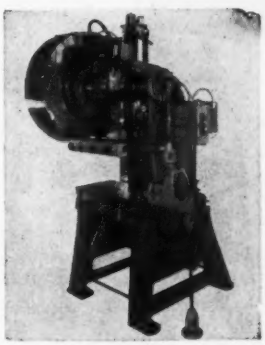


35 Standard Models 2 to 85 Ton Capacities



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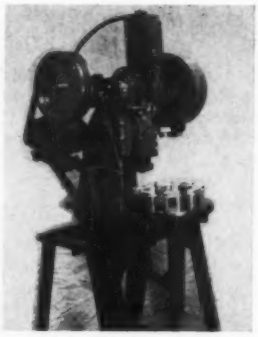
Mark Metal Parts with up to twelve ⅛" characters with a small power press. Model S-4K is equipped with an eight-station dial feed. It is easily convertible for various stamping operations by applying interchangeable station studs for each shape of part to be marked. Geo. T. Schmidt, Inc., 4112 Ravenswood Ave., Chicago 13, or — **Circle No. A29.**



With Model 300A Series of Presses it is possible to convert a 65-ton press to one up to 300 tons with easily installed kits. These kits cover 65, 125, 170 and 300 ton conversions. These presses are supplied with complete self-contained hydraulic systems and controls or as basic units to be connected to a central system. A. Dale Herman, Inc., 17071 Ventura Blvd., Encino, Calif., or — **Inform-A-Gram No. A30.**

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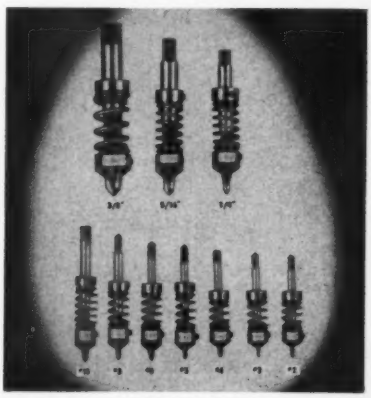
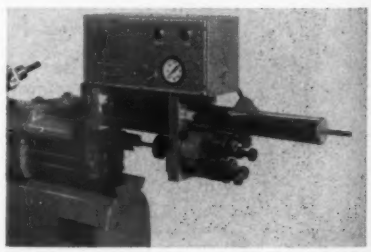
Debur a Tapped Hole while Tapping with the Burr-Bit chamfering tool. It is available in 12 sizes ranging from No. 2 to ½" to fit all two and four fluted taps. This device which slips over the tap, deburrs the



tapped hole as the tap is being withdrawn. It can be sharpened without having a special grinding fixture to grind the blades. Vernon Devices, Inc., 481 E. 3rd St., Mt. Vernon, N. Y., or — **Circle Inform-A-Gram No. A31.**

A Separate Feed for Each Turret Position with infinitely variable feed adjustments is a feature of Model HR-1 turret lathe converter. It operates on 50 to 100 psi air pressure.



The converter's rapid consistent mechanical cycling greatly increases both production and quality. Tool life is also increased by uniform pressure and feed rates. Sandex Automation Inc., 678 Berriman St., Brooklyn, N. Y., or — **Circle Inform-A-Gram No. A32.**

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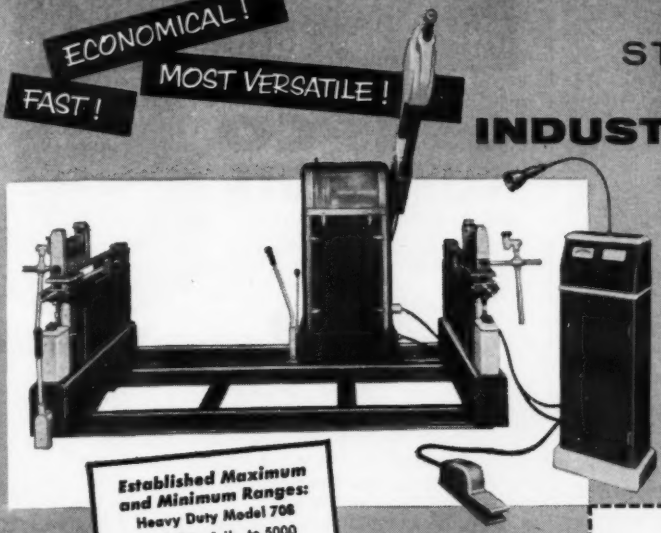

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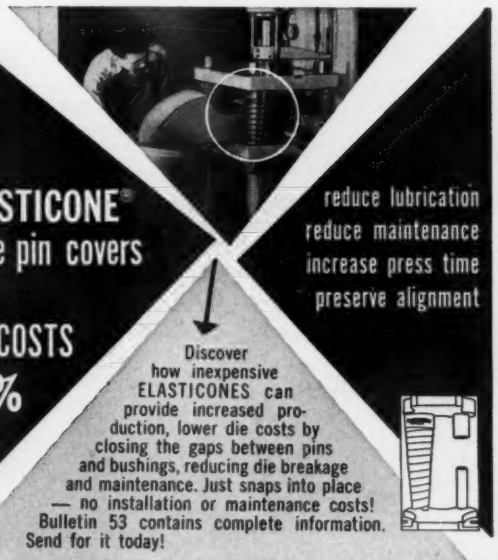
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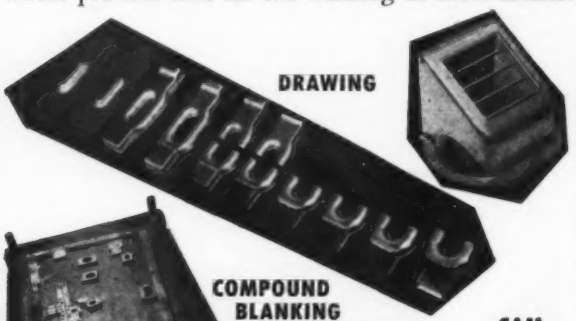

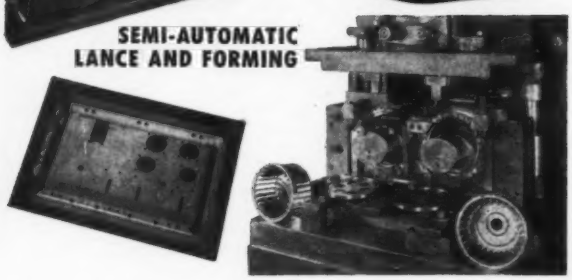

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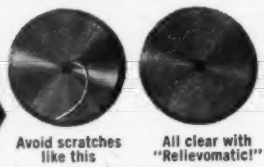

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Greater Versatility and Accuracy in Production Grinding are possible with TG-12 centerless grinder. It is used for centerless grinding of tungsten carbides, steels, stainless, plastic, nonferrous metals, etc. The grinder handles work from 0.004" to 1½" dia and can be used for either plunge or thru-feed grinding. Royal Master, Inc., 111 State Hwy 23, Riverdale, N. J., or —
Inform-A-Gram No. A33.

This Motor Driven Scrap Chopper operates entirely independent of the power press. Heavy-duty Model 400 features better lubrication and other features to give longer life with lower maintenance. Smaller models are also available. Durant Tool Supply Co., 1-15 Thurbers Ave., Providence 5, R. I., or —
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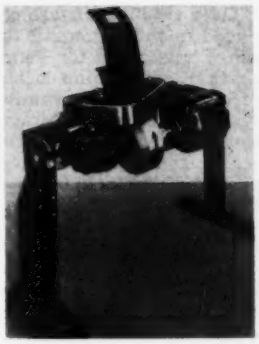
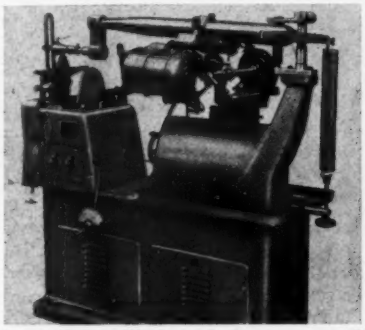


Eliminate Lathe Relieving with the Jemco automatic cutter, milling and grinding machine. It completely relieves each tooth, indexes and stops automatically. Multi-toothed and staggered tooth milling cutters for climb and conventional milling can



be relief milled and form ground also. The form grinding of each tooth provides an equal cutting load on the teeth and a better milling production. A template copying attachment increases its versatility. Jersey Mfg. Co., 456 Livingston St., Elizabeth, N. J., or —
Circle Inform-A-Gram No. A34.

Inspect 3-Dimensional Cams with the Alexander Universal optical measuring machine. It features tolerances as close as 0.00005". This machine records rectangular coordinate dimensions and controlled rotary

movements simultaneously. It is also adaptable for checking gears, threads, length measures and gap gauges. J. Arthur Deakin & Son, 150-28 Hillside Ave., Jamaica 32, N. Y., or —
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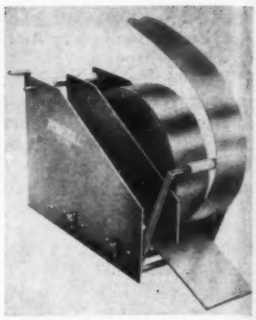
Over 1500 Pcs/Hr are produced by this automatic tapping machine for small parts. The machine consists of a vertical tapping unit, a vibratory feeder, a gravity track, an escapement, a work feeder and an ejector mechanism. The machine's basic design can be modified so that it can be adapted to automatic drilling or assembling. Automation Development Corp., 135 Reynolds Rd., Mentor, O., or — **Inform-A-Gram No. A37.**

This Improved Poweroll Coil Cradle can be moved from one press to another, wherever the advantages of an automatic slack loop are desired. The coil cradle can handle stock to 24" wide by 48" dia and up to 3000 lbs. The Poweroll feeds the press automatically. For literature on the coil cradle, contact The Medelton Co., 335 E. 142nd St., Bronx 54, N. Y., or — **Circle No. A38.**



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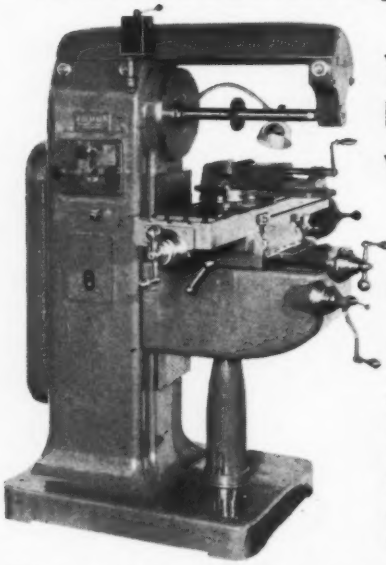

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• Simple, efficient, compact, with all operating parts enclosed, yet readily accessible. Unusually low-priced. Designed for the average tool room, yet highly suitable for production shops through its rigidity and low maintenance cost. Standard table 40" x 9", larger table optional.

The INDEX LINE also includes the Famous "SUPER 55" and the Popular "45" Vertical Mills

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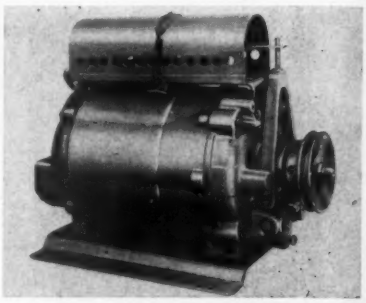
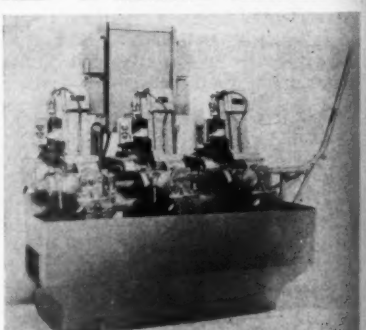
Remotely or Automatically Control Rapid Stop-Start Machine Operation with a solenoid-operated power transmitter. Type J is used for driving high production machine tools, winding and spooling equipment and

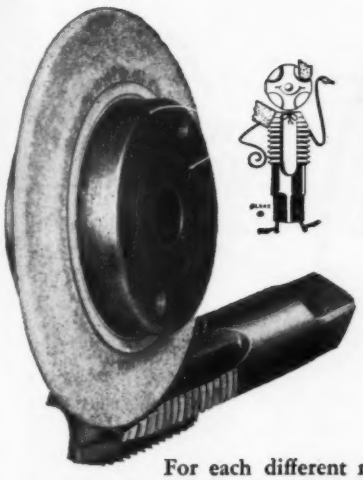


conveyors. The motor uses a constantly running motor-driven fly wheel with a short throw clutch. Diehl Mfg. Co., Finderne Plant, Somerville, N. J., or — **Circle Inform-A-Gram No. A39.**

Combine Three Operations in One Automatic Sequence using this new wet-or-dry belt centerless grinder. Model L4-3 is designed for high-speed volume production on ferrous, non-ferrous, plastic and other materials. It maintains tolerances of



0.001" or less, at through-feed rates up to 35 fpm. Typical grinding sequence is rough grind, finish grind and fine polish. The machine will accommodate stock from 3/32" to 2¾" dia, any length. Engelberg Huller Co., 831 W. Fayette St., Syracuse 4, N. Y., or — **Circle No. A40.**



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Controlled grinding of tap flutes and chamfers.

For each different material, there is a "best" rake or hook angle for tapping. You can grind and re-grind this angle on taps for each of your jobs . . . positively and accurately, time after time . . . with the BLAKE Flute Grinder.*

Combined with the BLAKE Chamfer Grinder, this machine can give you substantial savings even with Class 3 or 4 fit standards, because you will have:

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2. Exact indexing of cutting edges.
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4. Accurately relieved chamfers.

The increased uniformity and accuracy of your threads, plus *far* greater tap life, are the sound basis for maximum savings in your tapping costs.

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**Now available with air operated vertical slide.*

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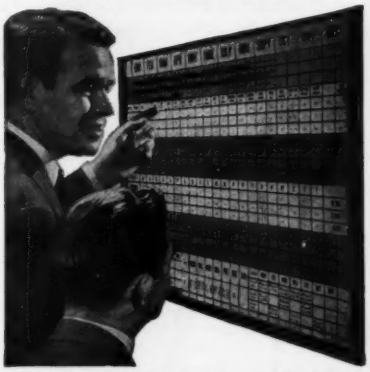

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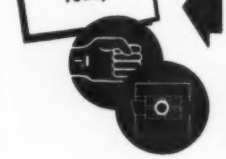

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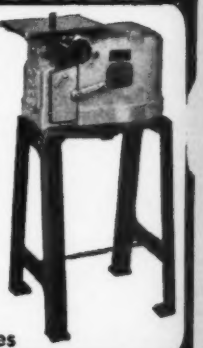

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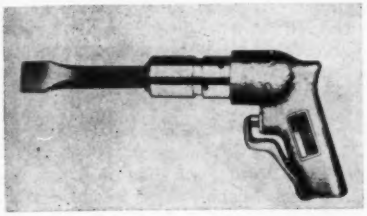
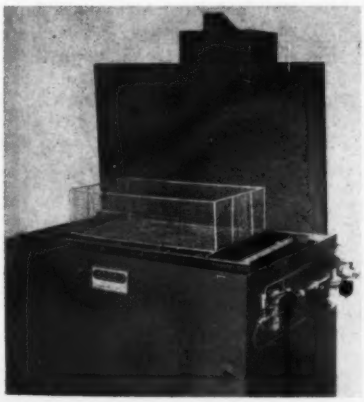


metering trigger controls the hammer's power from 0 to 9000 blows/min. Superior Pneumatic & Mfg., Inc., 4758 Warner Rd., Cleveland 25, or —
Circle Inform-A-Gram No. A42.

A New Fast-Action, Agitating Parts Cleaning Machine has been announced. It is available in Models MPC-3 and MPC-4 which are pneumatically-operated fully automatic agitation cleaners to be used cold or



with steam, gas or electric heat. The machine is designed for universal applications in the parts cleaning field and is adaptable for use with all solvents, alkalis and acidic solutions. Circo Equipment Co., Dept. P-1, Terminal Ave., Clark, N. J., or —
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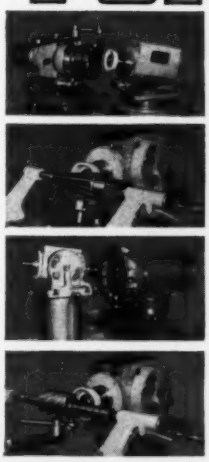

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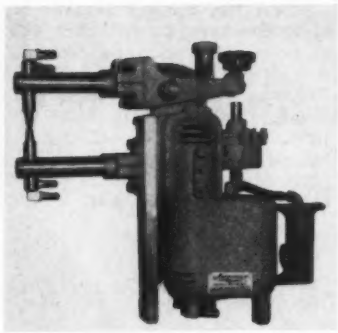
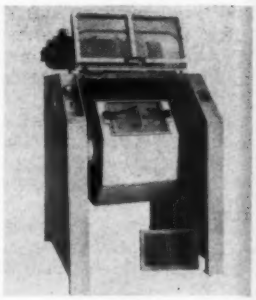


Designed for High Speed Applications is this new finishing barrel developed by The Abbott Ball Co., Hartford, Conn. It features a 22" x 33" barrel of welded steel plate with a capacity of 1,200 lbs. Available in either single or double compartment units with or without neoprene linings, the barrel operates at a speed of from 7 to 30 rpm. **Inform-A-Gram No. A46.**



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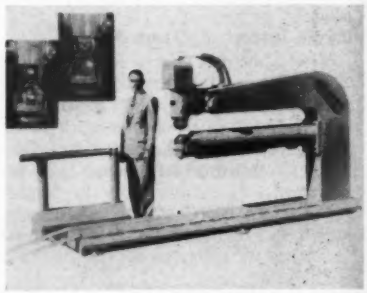
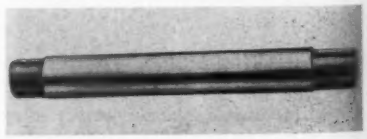
Steel 4-Post Tables have been added to the line of drafting tables produced by Mayline Co., Inc., Sheboygan, Wis. The entire base is of steel, including the drawers. The tables are available in five combinations. To each leg is attached a shaped wood shoe complete with leveler so that the table can be set in a perfectly level condition. **Circle Inform-A-Gram No. A47.**

This Weld Roll Planisher features rotating heads. The heads can be turned 90° and locked in position for planishing circumferential welds as well as longitudinal welds on tubes, tanks, cones and other shapes. This



6½-ton planisher has a 72" throat. Pressures up to 10 tons and up to 96" throat depth are available. Airline Welding & Engineering Co., 785 N. Prairie Ave., Hawthorne, Calif., or — **Circle Inform-A-Gram No. A48.**

A New Lathe Mandrel has been added to the line of Quality Brand Woodruff Key Seat Cutters manufactured by Quality Tool Works, 792 Market St., Waukegan, Ill. It is made



of hi-grade tool steel, hardened and ground with precision lapped centers, tapered to within 0.0005". The lathe mandrel is available in sizes 3/16" to 3" dia. **Circle Inform-A-Gram A49.**

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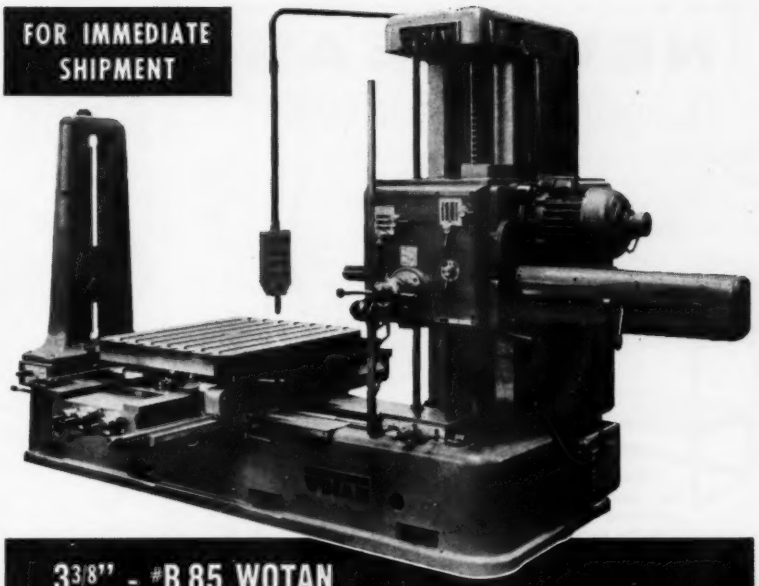

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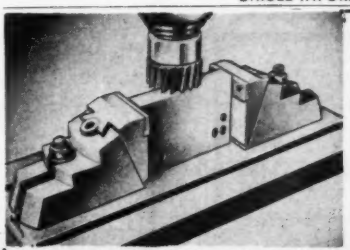

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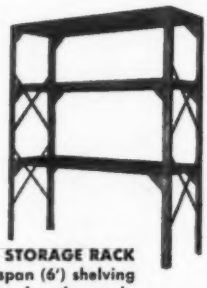

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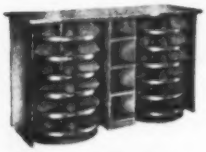

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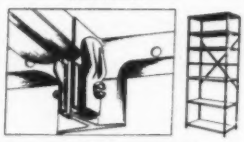

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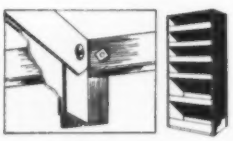

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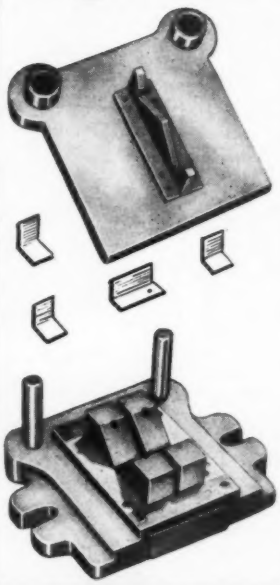
CIRCLE INFORM-A-GRAM KEY NO. 2281

Punches and Dies

Angle Iron Cut Off Die



No. 18, cut off die, for 2" x 2" x ¼" and lighter angles. Mounted in leader pin die set. Fits 'most all makes of 25-ton and larger presses. Simple shearing action insures straight, clean cut WITHOUT DISTORTION. Another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Also adaptors and die shoes to convert your press. Each precision-made.

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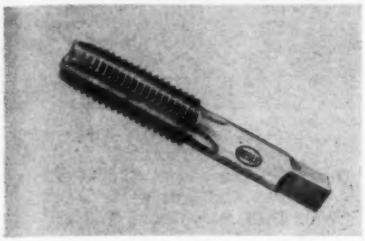
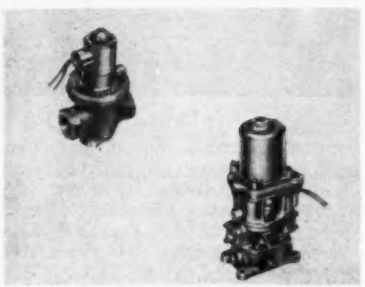
Effective in Tapping Cast Iron is the Strate-Face Tap. It has a straight cutting face with a scientifically determined rake angle for freer cutting. The Strate-Face Tap also provides greater accuracy in



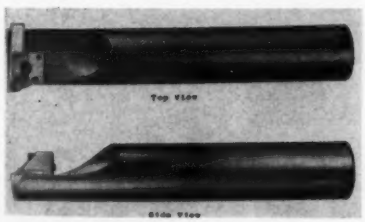
tapped hole sizes. The new flute and core design assures a stronger tap, longer tap life and less breakage. The tap is available in standard ground thread sizes from No. 6 through ¾". Besly-Welles Corp., S. Beloit, Ill., or —
Circle Inform-A-Gram No. A50.

Longer Life is a feature of the Starline Series of air control valves announced by Ross Operating Valve Co., 120 E. Golden Gate Ave., Detroit 3. There are five pilot heads which



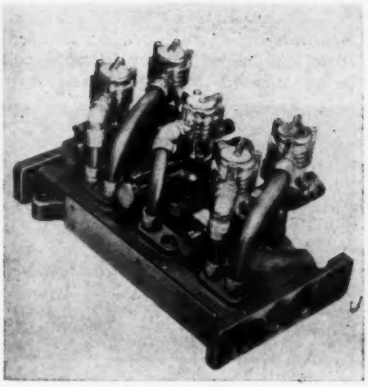
are interchangeable on seven valve bodies, providing 35 major model combinations. Available pipe size increases the variety of combinations to 210 models.
Circle Inform-A-Gram No. A51.

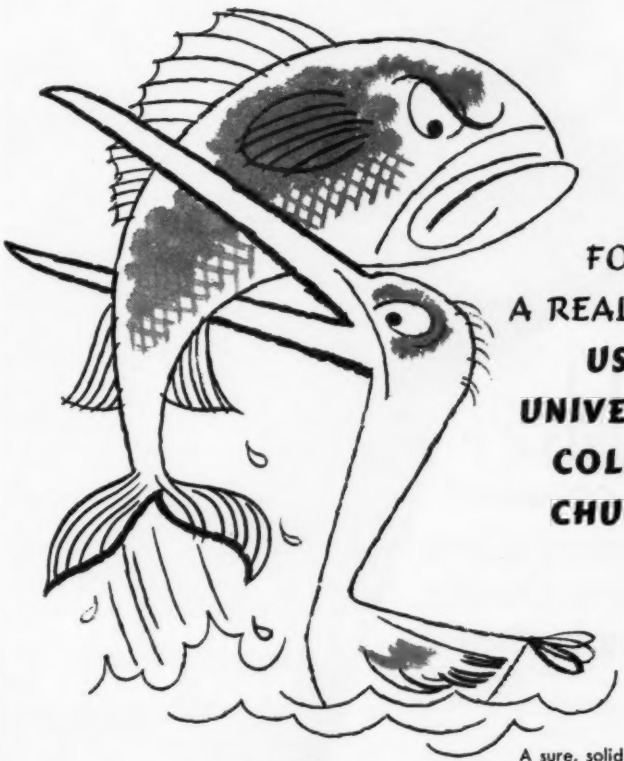
This Boring Bar with Chip Control is used on turret lathes, boring mills, etc. An adjusting set screw behind the solid carbide chip breaker permits quicker adjustments on-the-job



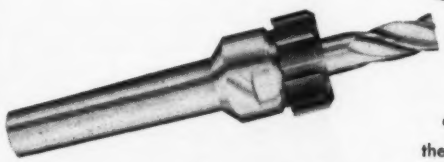
for various feeds and depths of cut, reduces tool-bit breakage and increases tool-bit life. Wedge-action clamping distributes the clamping action over a wider bit area. Everede Tool Co., 2001 N. Parkside Ave., Chicago 39, or —
Circle Inform-A-Gram No. A52.

Economical, Efficient Mounting of Speed King 2, 3 or 4-way valves in any desired combination is possible with a new manifold. The cast aluminum manifold, available in two and three station types, has full length inlet and exhaust ports. It can be adapted to any type of control valve application. Use of the manifold is said to reduce piping time and material costs at machine assembly. Valvair Corp., 454 Morgan Ave., Akron 11, O., or —
Circle Inform-A-Gram No. A53.





FOR
A REAL GRIP
USE
UNIVERSAL
COLLET
CHUCKS



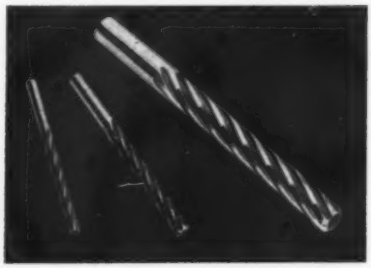
A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. Tools can't slip and tool shanks don't get scored. Even tool stubs and broken drills can be used successfully. Sizes range from 1/16" to 1 1/2", with shanks to fit any machine. Simplified design results in low chuck cost to you. Write today for new "complete line" catalog.

199

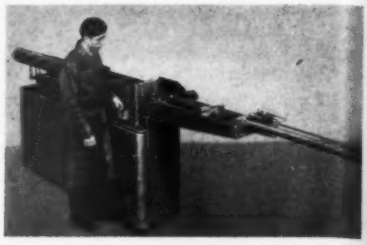
UNIVERSAL ENGINEERING CO. FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 229

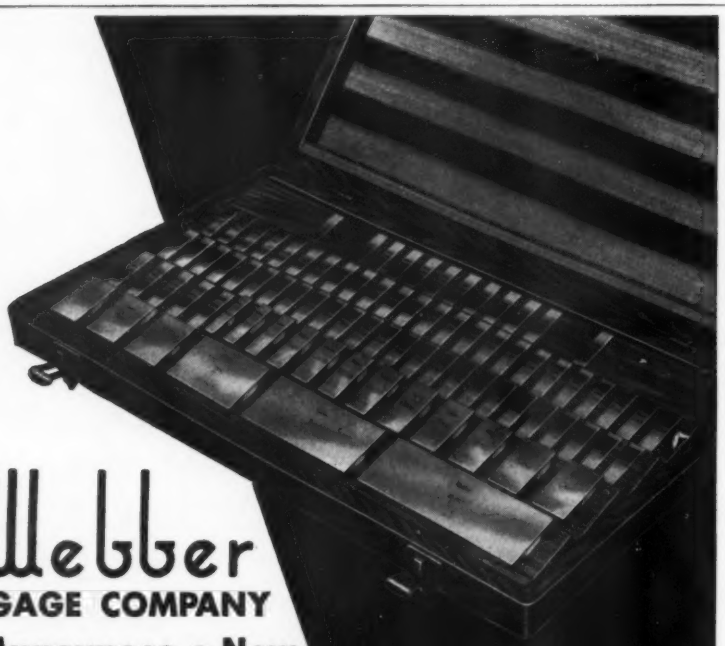
A Complete Line of Drill Length Reamers in standard sizes ranging from 1/16" to 1/2" dia by 64ths is now being offered by Ace Drill Corp., Adrian, Mich. They are recommended for machining ferrous materials on drill presses or automatics. The fluting is nearly twice the length of regular chucking reamers, allowing for frequent grind backs.
Circle Inform-A-Gram No. A54.



Automatic Broach Handling and Part Ejection are features of the new Red Ring self-contained, air-powered broaching fixture. It also has semi-automatic loading. The unit illustrated broaches a round hole in each of two 3/8" dia, 1" long bushings that



are pressed in a die-cast electric windshield wiper bracket. National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, or —
Circle Inform-A-Gram No. A55.



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GAGE COMPANY
Announces a New and even Greater Value in their . . . STANDARD STEEL GAGE BLOCKS

The new tolerances of these blocks are a special feature +.000008" —.000004" . . . parallelism and flatness .000003" . . . surface finish .6 — .8 micro inches rms.

Be on the safe side. Be sure your quality control is accurate — order a set of the new Webber Blocks today.

Complete 84 Block Working Set, sizes from .050" to 4.000", at a remarkably low price, only
$335
Including two .100" Steel Wear Blocks

Same set as above, but with two .100" Crablox wear blocks
$345.50

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GAGE COMPANY
12903 TRISKETT ROAD
CLEVELAND 11, OHIO

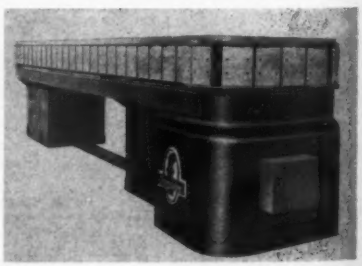
Send Your Order NOW to

LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS
CIRCLE INFORM-A-GRAM KEY NO. 230

Speed Printed Circuit Punching with the optical pick-up device that has been added to the Wales Fabricator-Duplicator punching press. The Dupl-O-Scope is mounted in the

stylus bracket of the Duplicator to optically sight-in on a master circuit while the Fabricator punches a corresponding master template. The device eliminates the need for expensive layout and drilling of templates. Wales-Strippit Corp., 345 Payne Ave., N. Tonawanda, N. Y., or —
Circle Inform-A-Gram No. A56.

A Redesigned Line of standard transfer machine bases has been produced by Ferguson Machine Corp., P.O. Box 5841, St. Louis 21, Mo. The range of applications has been widened and adjustments and maintenance simplified. The Trans-O-Mator straight line transfer machines

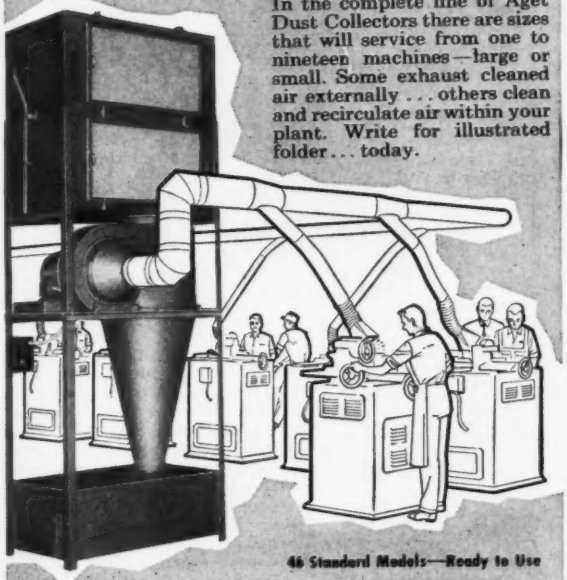


for automatic machining and assembly are available with strokes of either 6", 8", 12", 16" or 24" and with a choice of two types of carriers in various sizes. Standard lengths are 10', 14' and 18'.
Circle Inform-A-Gram No. A57.

just ONE DUSTKOP STOPS DUST

heavy duty unit services up to 19 MACHINES

In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.



46 Standard Models—Ready to Use

AGET manufacturing company

1394 Church Street • Adrian, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2311

Can your tapper pass this Performance Test?

(CHECK IF "YES" ONLY)

- ☐ Maintains production for long periods
- ☐ Less operator fatigue
- ☐ Fewer Broken taps
- ☐ Less "down time" interruption
- ☐ Fewer spoiled pieces
- ☐ Maintains accuracy at high speeds

If You Cannot Answer Yes to Each of the Above . . . Your Tapper is Not Operating Efficiently

There is a difference in tapping heads and in Procunier you'll find that unmistakable difference. If your tapper is not producing up to par—regardless of your demands and schedules—it will pay you to check into the possibility of using Procunier. They have been consistently producing "profitably" under "back breaking" production schedules everywhere!

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Procunier superiority can be attributed to many unique construction features: practical double cone cork faced friction clutch, wobble free spindle, quick start, stop and reverse mechanism, finger tip control, exclusive tap holder, plus others. Get the full story today.

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CIRCLE INFORM-A-GRAM KEY NO. 2312

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60° - 82° - 90° - 100° ANGLES

CHATTERLESS

Greater ease in cutting and longer life are the outstanding features of these WELDON tools for countersinking and deburring operations. Chatter is eliminated because of the single cutting edge. One trial will convince you.

Write for further details

WELDON Distributors throughout U. S. A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY

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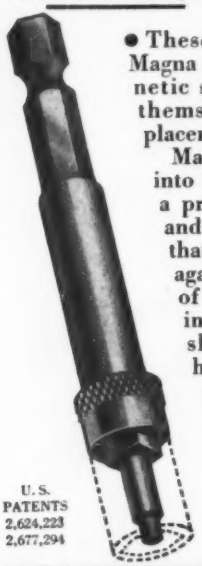
CIRCLE INFORM-A-GRAM KEY NO. 2313

Magna-tip® MAGNETIC SHANKS

For Driving Hex Head Sheet Metal and Self-Tapping Screws

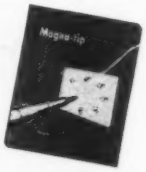
An Exclusive, Patented Magna Design



U. S. PATENTS 2,624,223 2,677,294

• These shanks, used with low-cost Magna sockets, replace standard magnetic sockets and quickly pay for themselves by eliminating the replacement of magnets.

Magnetic member, which projects into clearance hole in socket, has a protective tip of hardened steel and is spring-loaded to retract so that driving pressure is applied against shoulder in socket instead of on the magnetic tip. Socket... indicated in outline... is held on shank by a locknut with left hand thread. Available for all power drivers.



WRITE D-pt. 88X for manual on the complete line of Magnetic Bit Holders, Finders, Sockets and Hand Screwdrivers.

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ACCURATE • FAST • DEPENDABLE

HARDENED BED WAYS
Hardened and precision ground bed ways and cross-feed screw can be supplied in lieu of regular at small extra cost.

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A new, quality-built turret lathe that can deliver high output and close tolerances on precision parts. It features exceptional ranges of facing, turning, ram and threading feeds; handling ease and rigidity. Maximum efficiency on all types of jobs. Extremely adaptable to all jobs. Send for complete information if you are interested in producing more precision parts at lower costs. Prices start at $2438.

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Builders of lathes, milling machines, shapers, drill presses, pedestal grinders.

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REDUCE TAP COSTS UP TO 75%

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TAP SHARPENER

Push button control — no cams needed. 50 series for 2, 3, 4 flutes collet capacity to 1-1/16". 60 series for 4, 5, 6 flutes collet capacity to 2-1/4". Special orders for additional flute capacities.

Use on any tool and cutter grinder or small surface grinder . . . Guarantees precision sharpening through accurate grinding.

a low cost

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- quickly
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Thermo-Cote strippable protective coatings maintain high stability in the melt tank, resisting darkening and breakdown in use. This economical feature minimizes costly material waste and allows maximum reuse of Thermo-Cote.

Light and crystal clear when applied it provides excellent transparency for inspection and legibility with complete protection against rust, abrasion and corrosion.

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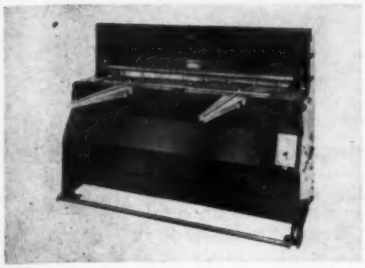
Handle Mild Steel Sheets up to 12-gauge thickness with new Whitney-Jensen power squaring shears in 3' to 6' sizes. No. 72 Series features four-edged blades, transparent



guards, calibrated gages and improved shaft bearings. The squaring shears come in three sizes: 36", 52" and 72" width capacities. Whitney Metal Tool Co., 724 Forbes St., Rockford, Ill., or — **Circle No. A58.**

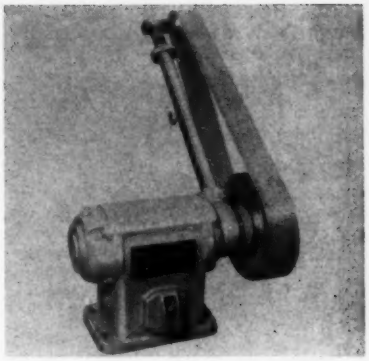
Automatically Chamfer Both Sides of Drilled or Reamed Holes with JF Series recessing tools. They can be used on any product manufactured with multiple drilling machines,

transfer machines or other high production machinery. The recessing tools feature long-lived circular form cutters and an actuating mechanism of a rack and gear. Maxwell Industries, Inc., Macedonia, O., or — **Circle Inform-A-Gram No. A59.**

Fast, Profitable Machining of Irregular Shapes is assured with a new hydraulic multi-cycle tracer lathe. Only one template is required for multi-cycle cuts. With Model 14T, two ruffing cuts, a semi-finish, and

a finish cut can be obtained in one automatic cycle. An indexing tool turret permits the use of two cutting tools, one for ruffing and one for finishing. Sundstrand Machine Tool Co., Rockford, Ill., or — **Circle Inform-A-Gram No. A60.**

Grinding, Polishing and Deburring Applications are handled by a lightweight, compact grinder. Model DBA-O bench grinder develops a speed of 5100 sfm providing quick, cool stock removal on all jobs. By use of direct drive of the contact wheel, there is no loss of power or speed of the abrasive belt. For details, request copies of Form A-1386 from The Carborundum Co., Curtis Machine Div'n, Jamestown, N. Y., or **Circle Inform-A-Gram No. A61.**



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Wisconsin Rotating Drill Head with planetary gear drive.

Adjustable and Fixed Spindle Drill Heads and Tapping Heads, Lead Screw Tapping Units, Special Machines. Fixtures, Fixture Bases, Index Tables. Write for literature.

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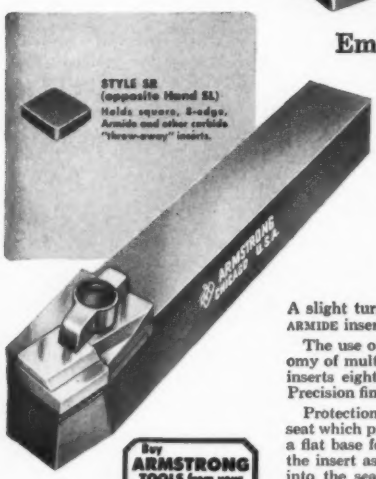
This New Series Geneva Motion Index Table with 16 through 36 stations has a 24" dia dial plate. However, Model PDC-AM24 can easily handle dial plates up to 36" dia. It is powered with a rotary air motor drive that indexes in 1 sec and locks accurately to ±0.001 at the 24" dia, carrying a 1000-lb load. Precision Detroit Co., 20100 Sherwood Ave., Detroit 34, or —
Circle Inform-A-Gram No. A62.

Pre-Assembled Stacks of Multiple Belleville Spring Washers are now being offered by Associated Spring Corp., Bristol, Conn. They are held together by pins or rivets passing through the washers at or near their neutral axis. The compact energy "cartridge" can be incorporated as a one-piece component in the final piece. It is easier to install and provides high loads with small deflection.
Circle Inform-A-Gram No. A63.

New
ARMSTRONG
Armide CARBIDE INSERT
TOOL HOLDERS



Embody...Convenience, Economy
Simplicity and Strength
based on these superior features:

- IMPROVED CLAMPING METHOD — speeds indexing of Inserts.
- REPLACEABLE SEAT of Hardened Tool Steel — protects shank and provides flat base to prevent damage to inserts as they are clamped in position.
- SHANK of Heat Treated Alloy Steel — gives extra strength and rigidity.

A slight turn of a single screw permits rapid indexing of the ARMIDE insert — reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts — triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

Buy ARMSTRONG TOOLS from your Industrial Distributor

Write for catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5220 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

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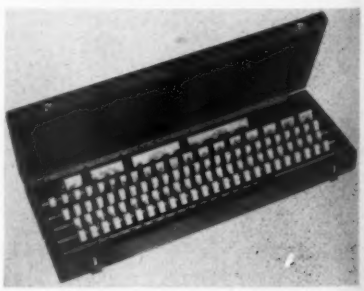
A Simple, Low Cost Single Acting Cylinder is now being produced by Sahlin Engineering Co., Inc., P. O. Box 289, Birmingham, Mich. It can be adapted to lifting, ejecting, clamping, back gaging and other similar applications. The cylinder with two moving parts measures 3½" plus stroke in length and 1¼" dia, and can be actuated by a 30 psi air line.
Circle Inform-A-Gram No. A64.

These Johansson Thrift Blocks have an accuracy and parallelism of ±0.000008" and flatness within 0.000006". The Thrift Jo's give Class B block accuracy. Two sets of blocks are available. Set No. 1 consists of 84 blocks, which in combination will produce a half million different gage sizes. Set No. 2 with 36 blocks will produce over 150,000 different gage sizes. Brown & Sharpe Mfg. Co., Providence 1, R. I., or —
Circle Inform-A-Gram No. A65.



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PRECISION INTERNAL GAGE Sizes from ⅛" to 10" and larger

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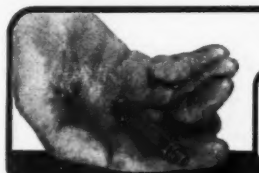

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IN 11 SIZES No. 6 to 1" N.C. In all S. A. E. sizes.

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work now—save money too!

HEIMANN MFG., CO. • URBANA, OHIO

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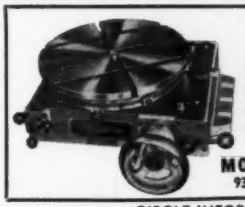
Have you seen the entirely new Metlfax magazine? If you work in the metalworking industry or if you sell to the metalworking industry you should investigate this new book. For your copy write Dan Daniels 1975 Lee Road, Cleveland 18, Ohio.



NEW Advance 15" Rotary Table has accuracy to within 30 seconds. This rugged piece of equipment is designed for all types of close tolerance work requiring rotational accuracy, with maximum speed and precision and minimum maintenance.

MORRISON ENGINEERING COMPANY

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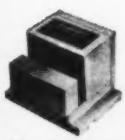
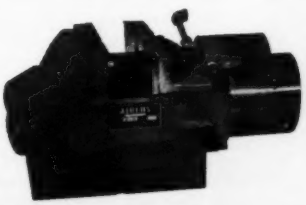
AIR VISES — ALL TYPES GRIPS — 5 TO 200 X AIRLINE PRESSURE



POWER HEADS



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TERMINAL CRIMPERS

SPECIAL PRESSES

CYLINDERS

by **production devices incorporated,** Whitehall, N. Y.

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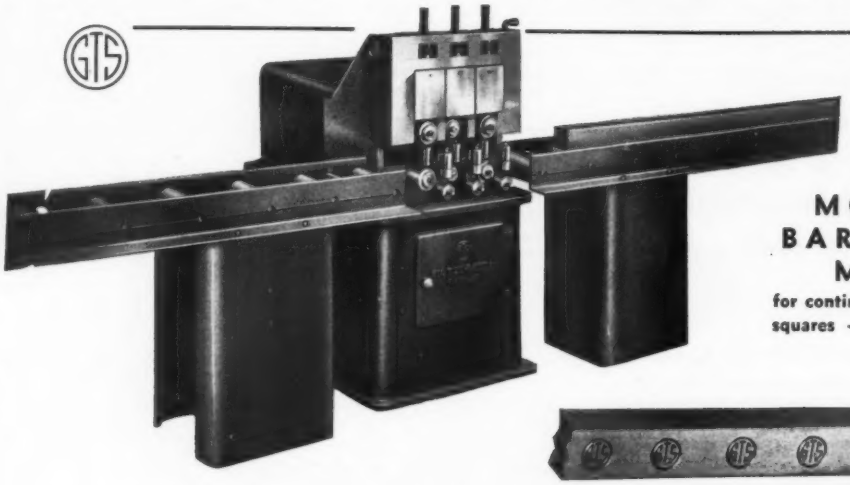
Precision . . . Speed . . . Versatility



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BAR MARKING
MACHINE
for continuous marking on flats — squares — rounds — octagonals

Simple horizontal and vertical adjustments on this unit fix the work for precision operation. Bars may be marked on one side only or on opposite faces. Intermittent marking is obtainable at desired intervals up to 9 in. Lettering knurls can be quickly changed by removing a single screw. Feed and discharge roller bearing tables are available with the unit.
Write today for full information on Model 295, or any part of the famous GTS line of marking equipment.

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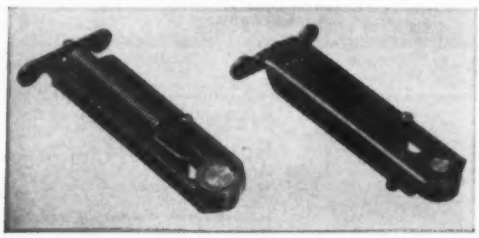
4112 Ravenswood Avenue
Chicago 13, Illinois

If it's Worth Making, It's Worth Marking.

CIRCLE INFORM-A-GRAM KEY NO. 2361

FOR POSITIVE STOCK ALIGNMENT
IN PROGRESSIVE DIES



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SPEED UP PRODUCTION with precision-made AMCOR Roller Stock Pushers. Easy, smooth stock feeding, without buckling, assures more production with less operator fatigue.

SAVE MONEY. AMCOR Roller Stock Pushers sell for just a fraction of what hand-made bench models cost to make.

SIMPLE TO INSTALL. Requires only a slot milled in the stripper plate, and a hole drilled in the die block and stripper plate. Tracing template for slot and hole location is supplied. When die is sharpened, no refitting is necessary.

The AMCOR Roller Stock Pusher is quickly adaptable to any work specifications. Distributors throughout the country stock a complete line of nine models to fit all production needs.

Write us for complete information

APPLIED MECHANICS CORPORATION
P.O. BOX A882 GRAND RAPIDS, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2362

OPERATE HORIZONTAL MILLING MACHINES?

FREE DETAILS illustrate how you can increase horizontal milling machine feeds and speeds up to 200%. Jergens tapered roller bearing bushing replaces present bronze bushing at low cost without machine change. Eliminates bushing wear, cutter breakage, arbor wear, scoring and chatter. Permits use of carbide cutters to full capacity on new or old machines. Write for cost cutting facts today!

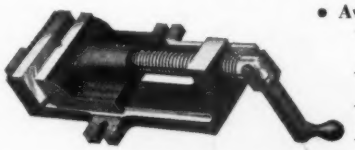
DONLEY PRODUCTS, INC.
DEPT. TP-4, 11106 Avon Ave., Cleveland 5, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2363

NEED A VISE? Check YOST First!

Write today for bulletin on the extensive Yost line.

Here is the **YOST** DRILL PRESS VISE —



- Available in two sizes:

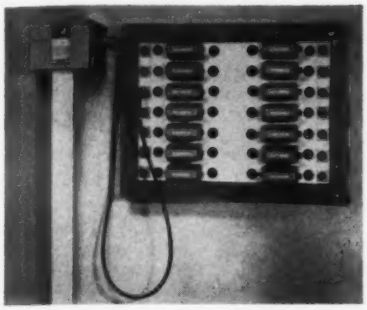
No.	Jaw Width	Max. Opening
1D	3½"	4"
2D	5"	5½"

- Does away with special and costly jig fixtures.
- Developed expressly for use on drill press operations.

YOST MFG. CO. 124 Grant St., Cambridge Springs, Pa.

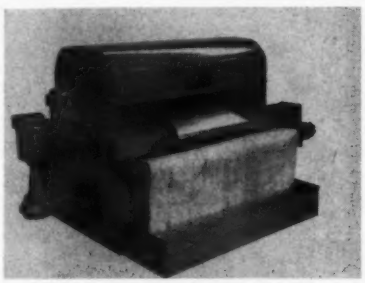
CIRCLE INFORM-A-GRAM KEY NO. 2364

Count and Record Screw Machine Production with this new Count-O-Larm system. The system shown was installed in a screw machine



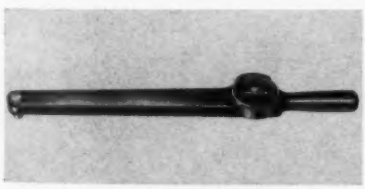
shop to keep track of 14 machines. Only the production of full-length parts is recorded. Count-O-Larm Co., 1910 N. Elston Ave., Chicago, or **Circle Inform-A-Gram No. A66.**

Efficient Filtering of Coolants requiring the removal of foreign particles is provided by the Barnesdrill Kleenall Filter. The redesigned filter has a trough type intake distributor



to facilitate cleaning. In addition, the size of the seal wheels has been increased to provide greater area for sludge build up. Barnes Drill Co., 872 Chestnut St., Rockford, Ill., or — **Circle Inform-A-Gram No. A67.**

A New Rigid Frame Torque Wrench has been announced by Apco Mossberg Co., Attleboro, Mass. It features a large dial for easy reading of torque and a removable and reversible plug. The fully enclosed



wrench is designed so that pressure can be applied anywhere on the wrench, and a handle extension can be used if desired. It is available in four ranges — 0-300 and 0-2400 in-lbs and 0-25 and 0-200 ft-lbs. **Circle Inform-A-Gram No. A68.**

Grind a 180° Radius in a Single Setup with the Nassau convex radius grinder. It will also grind either the right or left side of a milling cutter or a single point tool to a 90° radius. Form dressing of the wheel is eliminated. Cutters up to 6" dia and from almost zero to 2" thick can be ground on this machine. Nassau Tool Work, 208 Meacham Ave., Elmont, L. I., N. Y., or — **Circle Inform-A-Gram No. A69.**

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TIME • LABOR
MATERIALS
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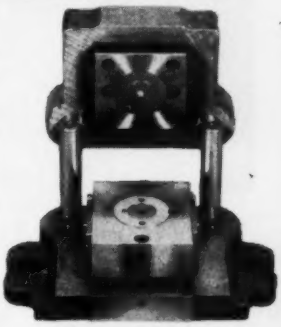

Made in 5 sizes:
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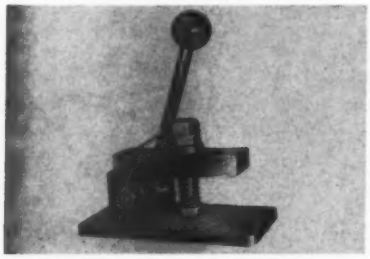
Phone: Slocum 7-4800 Suburb of Detroit

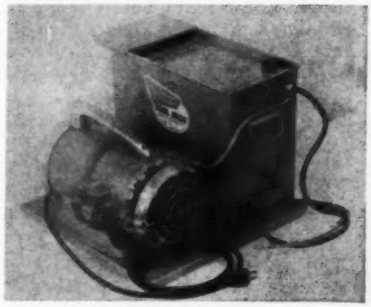
CIRCLE INFORM-A-GRAM KEY NO. 237

New Features have been added to the cam lever clamp assembly produced by Monroe Engineering Products, Inc., 1515 Hurd Rd., Monroe, Mich. A hexagon shaft connects the handle to a cam. A pin in the cam face engages a hole in the bottom of the clamp, moving it forward to a clamping position. Expensive mountings requiring machined castings or weldments have been eliminated, only three tapped holes in a fixture base are needed.



Circle Inform-A-Gram No. A70.

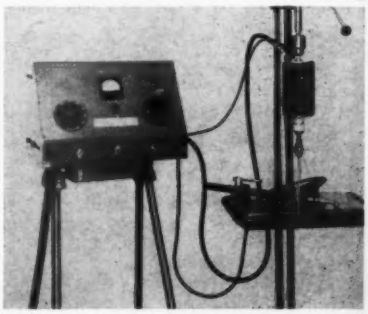
Eliminate Dry Machining Methods with the Wesco Tool-Mist Coolant System. Portable, self-contained Model 99 has a 3½ gal capacity. It



features individual controls for both air and liquid. Simple adjustment gives the right spray for any metal cutting operation. There is no interruption in operations when installing Model 99. Lloyd Tool Corp., P. O. Box 647, Burbank, Calif., or —

Circle Inform-A-Gram No. A71.

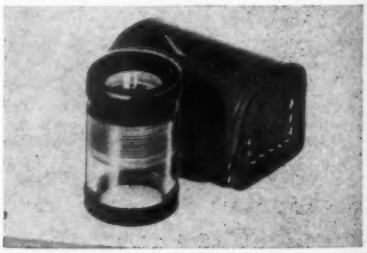
Cut Hard Metals such as hardened steels, carbides, titanium, cast alloys, armor plate, tungsten, and nickel, with a new disintegration machine. Among other things, Model C-56 can be used for cutting dovetails in hardened dies and tools, new centering



holes in taps, internal and external keyways and slots, and oil holes. In addition, it can be used for removing broken taps, etc. The Cammann Mfg. Co., Inc., 2700 Henninger Rd., Cleveland 9, or —

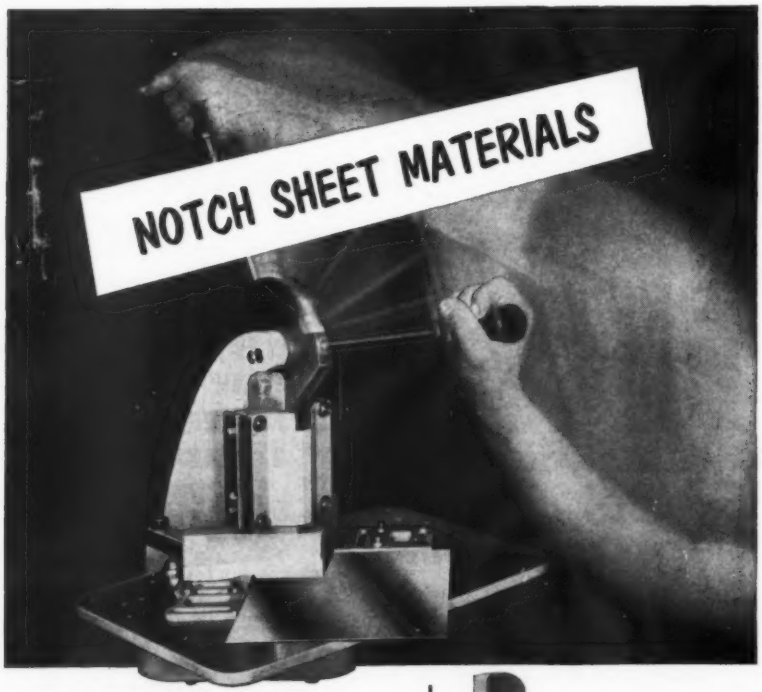
Circle Inform-A-Gram No. A72.

Used for On-The-Spot Checks for Linear Dimensions, diameters, radii and angles is the new Edmund Measuring Magnifier. This pocket-size comparator is ideal for checking and



examining small parts. When the reticle is removed, the comparator becomes a 6-power magnifier. Edmund Scientific Co., Barrington 21, N. J., or —

Circle Inform-A-Gram No. A73.



Do It Quickly, Easily with a DI-ACRO* NOTCHER

Speed up notching operations, eliminate the need for heavy presses and dies. A 6″ x 6″ notch is made in 16 guage material in one operation. Also perform many straight shearing jobs.

DI-ACRO POWER NOTCHER

Especially designed for operations where a high rate of production must be maintained. Motor driven flywheel and all moving parts housed in a welded, steel cabinet.

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CIRCLE INFORM-A-GRAM KEY NO. 238

New! "TRICO-MIST" COOLANT SYSTEM

FOR DRILLING — TAPPING — MILLING
SAWING — GRINDING, ETC.

- *Portable*
- *Efficient*
- *Inexpensive*

Removes heat from cutting edges of tools and work. Feeds can be increased considerably, finer finishes and accuracy are obtained. TRI-CO-MIST absorbs heat, thereby quenching it faster than flood coolants which only transfer it. Chips slide freely up the tool face and are blown away automatically. Simple needle valve controls size and volume of mist spray. Unit attaches to shop air line, (25 to 150 lbs.)

- Speeds and production are increased.
- Tool life is increased — stay sharp longer.
- Permits heavier roughing cuts — saves time.
- Cutting saws last 80% longer.
- Diamond wheels last 5 to 10 times longer.
- Prevents thermoplastics from welding to tools.
- One gallon coolant lasts 14 hrs., average use.
- Available with one and five gallon containers—single or multiple outlets — single or dual valve controls.

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TRICO FUSE MFG. CO. MILWAUKEE, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 2391

UNWIELDY PARTS HELD TIGHT

At North American Aviation, Inc.

The picture above shows two sizes of dependable Knu-Vise clamps as they are used on a setup designed by North American's tooling specialists. Operation is the assembly of a bulky, hard-to-handle fuselage section of a F-100 Super Sabre.

With speeds faster than sound becoming more and more common, quality control measures and exacting tolerances in aircraft production are vital. That's why positive—fast to grip—quick to release Knu-Vise clamps are so important. Many fixtures are designed for air or oil operated clamps; others, like North American's, for manual operation. Lapeer furnishes a complete line numbering more than 150 models of clamps and pliers. Better investigate this versatility—today. Just write,

Manufacturers of over 150 models of manually and air-operated clamps and pliers

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3064 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

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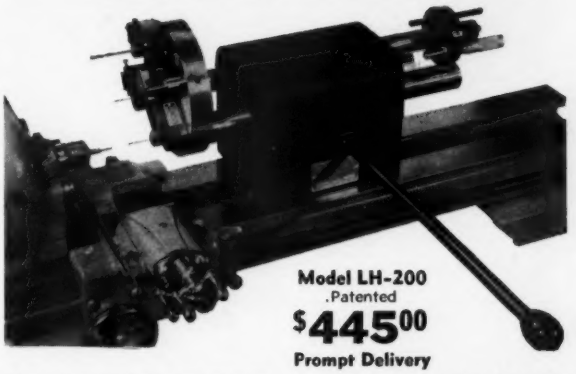
SAFE • FAST • ACCURATE • PROFITABLE

New CONCENTRICITY HEAD with MICROMATIC CONTROL



Model LH-200
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LH-200 EXCLUSIVE FEATURES:

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- From one lathe to another in 20 minutes for 6" swing and up.
- One adjustable master pilot for accurate indexing.
- No floating or adjustable holders required for misalignment.
- A new lock stop for fast precise setting.
- Six ⅝" dia. bores for accurate tooling.

GUARANTEED TO SATISFY OR YOUR MONEY BACK!

The HAWKEYE Company has a complete line of accessories for the LH-200.

HAWKEYE SPECIALTY CO. 1532 West 14th Street Davenport, Iowa

CIRCLE INFORM-A-GRAM KEY NO. 2393

"ADJUSTABLE STROKE" MIDGET Air-Clamp* CYLINDER

*TRADEMARK

Now—put pressure where it's wanted instantly and cheaply, with Mead's powerful new midget air cylinders (1" bore, single-acting, spring return—horizontal and vertical). Stroke is adjustable. Cut costs—use 'em singly or in groups to move, hold, press or eject small work pieces; to close and open large jigs, forms, fixtures. They'll replace human fingers and mechanical clamps in countless routine jobs.

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4114 N. Knox Ave., DEPT. H-47-A
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CIRCLE INFORM-A-GRAM KEY NO. 2394

FASTER MOLD RELEASE
FINER FINISHED PARTS

with

MOLDS *SUPER POLISHED*

by ACME scientific

Molds are sent to Acme Scientific from all over the United States for finishing. The exclusive techniques are a refinement of lapping procedures and optical finishing methods.

More than just a polishing process that gives a reflective, though often defective surface, this precision mold finishing process leaves a metallurgically clean surface that insures faster mold release for up to 20% greater output—provides a flawless finish.

The surface finish for optical lens molds is made as low as .2 to .5 micro inch. Molds for external and internal surfaces are finished to 1.5 to 3 micro inches. The deepest scratches are removed—corners are kept sharp.

We invite you to send a trial mold as an initial order. See for yourself how Acme's craftsmen are skilled in precision mold finishing. Prices quoted from marked prints.

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CIRCLE INFORM-A-GRAM KEY NO. 2401

NUMBERALL

CUTS THE COST OF STAMPING NUMBERS

NEW MODEL 70

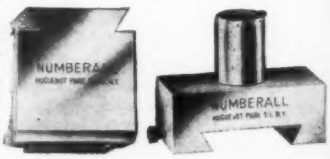
MULTI-WHEEL NUMBERING MACHINE

The most efficient method of stamping numbers into metal. Repeats the same numbers until changed. Model 70 NUMBERALL machines are used in all industries to mark various parts. Stamps numbers, etc., quickly . . . neatly. Perfectly aligned. Much better marks are produced by these machines than by single stamps or steel type, and at a far lower cost. Shank for Hand or Press and with any number of wheels from 3 to 20. Can be furnished in 1/32" to 3/8" high figures, sharp face gothic or shaded roman style. Write for Bulletin TP-70.

Hand shank Model 70 illustrated. Press shank for foot or power presses also available.

DOVETAIL ADAPTER
Model No. 116

SINGLE or MULTIPLE LINE TYPEHOLDERS with Dove Tail Shank allow **Quick** Changing of Type without taking holder out of the Press.



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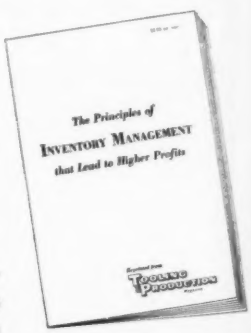
NUMBERALL STAMP & TOOL CO.
HUGUENOT PARK STATEN ISLAND 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2402

The Principles of
INVENTORY MANAGEMENT
that Lead to Higher Profits

by Nyles V. Reinfeld



. . . a 32-page treatise.

"The application of the specific principles outlined in this paper will provide for more economical operation, by reducing costs and balancing inventory, and will improve customer delivery.

"The techniques described require very little mathematical training, never exceeding high school algebra.

". . . experience has shown that plant personnel with very little training can learn to use these techniques on their own and will obtain very satisfactory results."

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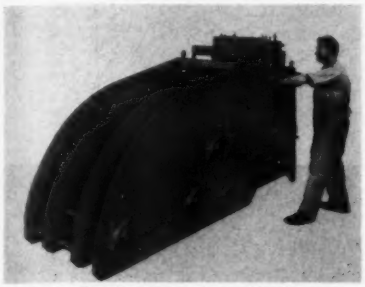
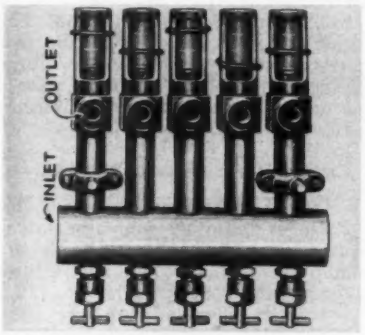
4,000 Lbs Maximum Capacity is a feature of the latest heavy duty Koil Kradle Straightener. It accommodates coils up to 60" dia and 18" wide. Maximum stock thickness handled is 0.045". The combination of cradle



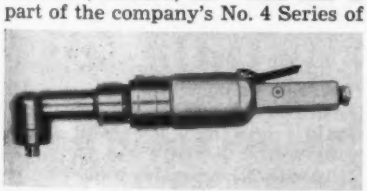
and straightener automatically supplies a controlled slack loop of straight, flat stock from which any machine can draw. Benchmaster Mfg. Co., 1835 W. Rosecrans Ave., Gardena, Calif., or —
Circle Inform-A-Gram No. A74.

A New Pressure Sight Flow Lubricator has been announced by Wm. W. Nugent & Co., Inc., 3440 Cleveland St., Skokie, Ill. The unit will deliver lubricating oil or other liquids



under pressure, in accurately measured quantities, to high or otherwise inaccessible points. It is available as a single unit or in multiples to 15 depending upon the number of feeds required. All are designed for 125 psi maximum working pressure.
Circle Inform-A-Gram No. A75.

Capacities Up To ½" Bolt Size are a feature of a new line of right angle nutsetters announced by Thor Power Tool Co., Aurora, Ill. This line is part of the company's No. 4 Series of



industrial air tools. These nutsetters are offered with direct drive in six models and two types. They have unit type attachments, interchangeable from one machine to another.
Circle Inform-A-Gram No. A76.

Now Available in 12 Standard Sizes is the Liqui-Jector, a liquid-gas separation device for removal of liquids and solids from air, gas and steam systems. The device provides clean, dry air for operating pneumatic equipment and control and recording instruments. It also dries and cleans gases. The Liqui-Jector was formerly produced only as a specially designed unit. Selas Corp. of America, Dresher, Pa., or —
Circle Inform-A-Gram No. A77.

Produce Acme Threads in a Single Pass without using a leadscrew with the Unipass acme tap. It eliminates the excessive cost of multiple sets of

taps and lead screw equipment and reduces machine time. Because starting threads serve as a pilot, reaming is eliminated. The tap is available in all standard sizes. Beloit Tool Corp., Regal Div'n, Beloit, Wis., or —
Circle Inform-A-Gram No. A78.

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FEDERAL
DIAL INDICATORS

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LOW FRICTION
Any Graduation
Plain or Jeweled

UNIT MOVEMENT
Assures Perfect Alignment
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You get a known accuracy and dependability built up over years of development and experience.

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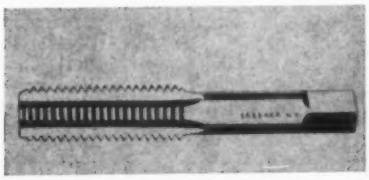
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

CIRCLE INFORM-A-GRAM KEY NO. 241

Obtain Super Lubrication at the Point of Cutting with the "elektra Lube" tap. The "elektra Lube" process imparts a thin ductile deposit which is not subject to chipping or peeling. The tendency of the material to stick to the cutting surfaces of the tap is greatly reduced, resulting in smoother threads in the workpiece. Sossner Tap & Tool Corp., Lynbrook, N. Y., or —
Circle Inform-A-Gram No. A79.



A New Synthetic Coolant has been developed by Daubert Chemical Co., Chicago. Cool-Speed is used for many machining operations and for grinding. It is reported to produce better finishes on cast iron, brass, aluminum and various steels including stainless. Its features include rust prevention, cleanliness and lack of rancidity.
Circle Inform-A-Gram No. A80.

Foster Automatic Control
Reduces Scrap & Improves Quality

mounts on any grinder to solve your external cylindrical grinding production problems

Foster Electrosizer assumes complete control of the actual grinding cycle and eliminates the human element of error in production grinding. Close tolerances are held consistently. Wheel life is increased by consistent grinding speed.

It's compact and readily installed on most any hydraulically or electrically operated machine and is so simple in concept that set up and size change is a matter of seconds.

Can be readily adapted for full automation.

1
Operator engages caliper, cocks gage, and advances the wheelslide.

2
Machine grinds at fast feed until within a few thousandths of exact size.

3
The gage signals the machine to reduce grinding speed and go into extremely fine feed. This improves finish and corrects any out-of-round condition.

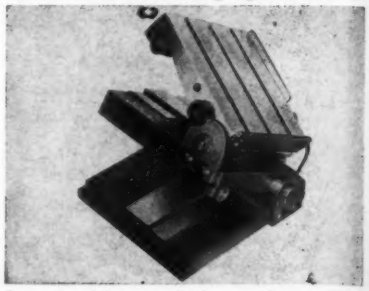
4
When size is reached, gage signals the wheelslide to retrace.

ALSO
Foster Visual Control
and Snap Gages

Write for full information

FOSTER
ENGINEERING
CORPORATION
4200 N. Woodward
Royal Oak, Mich.

Fast, Accurate Setups of Compound Angles are performed by Model 1905 compound sine plate. Both compound and single angles can be set up on this sine plate that is used on machining operations or



for checking and inspecting. The top plate is 6¼" square and provided with three Tee slots for holding the work. The base and middle plate each have 0.2000" recess to facilitate use with small angles. Bald Eagle Corp., 256 Cedar St., St. Paul 1, Minn., or —
Circle Inform-A-Gram No. A81.

Step Up Tool Life in cutting all metals, especially the new harder alloys, using a new type coolant, Royal Flush 306F. It involves the electro-magnetic attraction of a water-borne catalyst to the tool. This catalyst stops pick-up on the tool, keeping it uniformly cool. Royal Flush 306F leaves no film on parts. Folden Chemical Ltd., 9015 Wilshire Blvd., Los Angeles, will supply details, or —
Circle Inform-A-Gram No. A82.

Obtain Maximum Utility for Jigs, Fixtures and other shop applications using new hand wheels. These new additions to the line manufactured by Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, are light-

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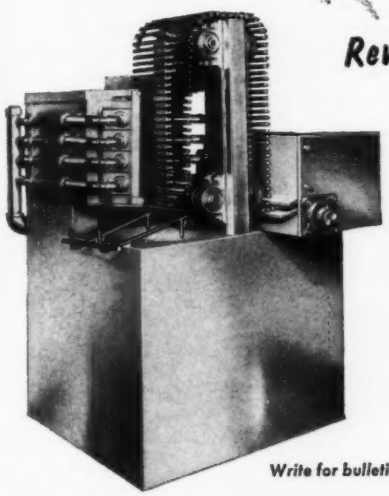

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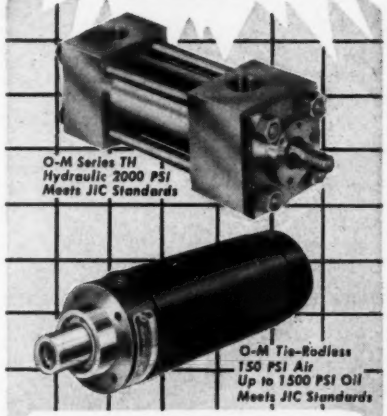

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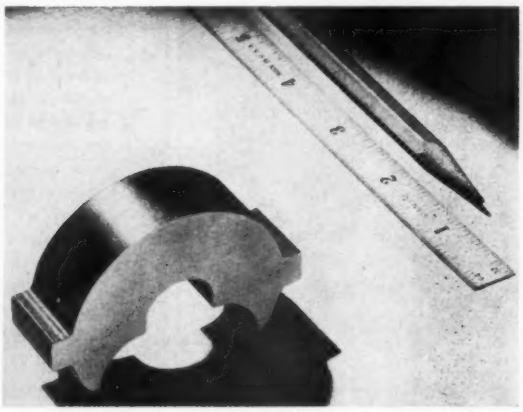

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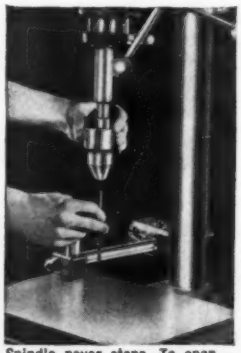

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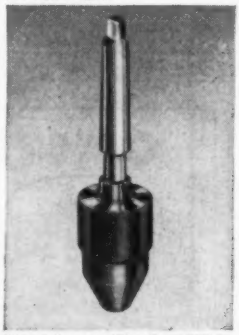

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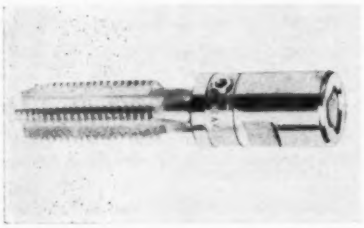

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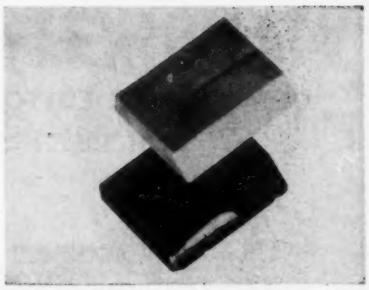

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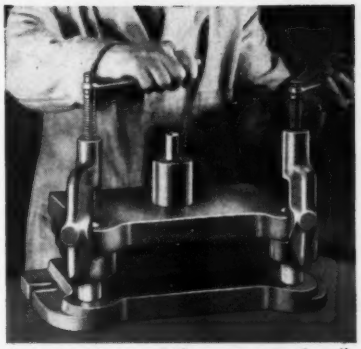

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TOOLING & PRODUCTION Magazine

The number of subjects on which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

The Publisher

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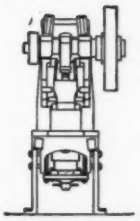

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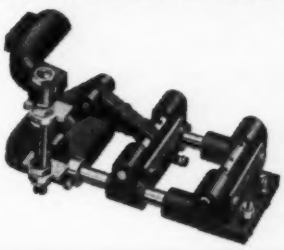

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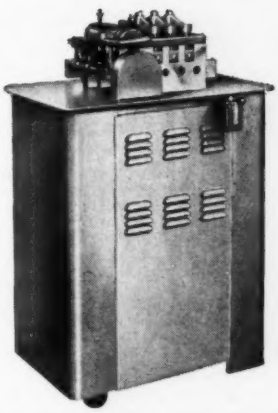

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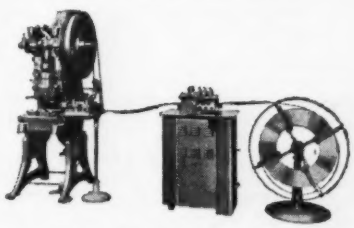

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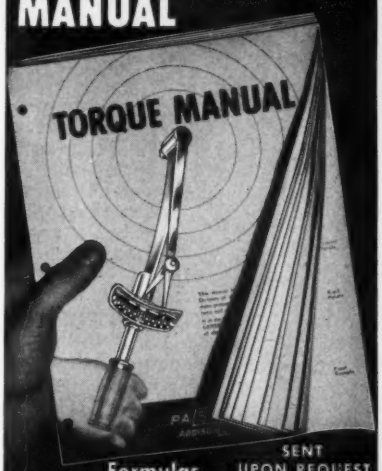

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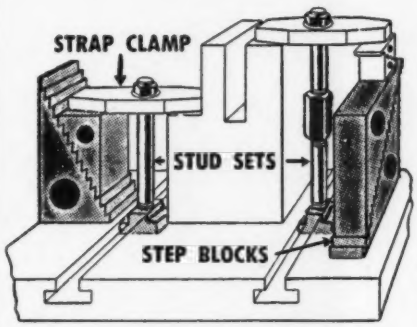

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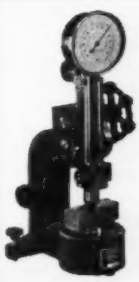

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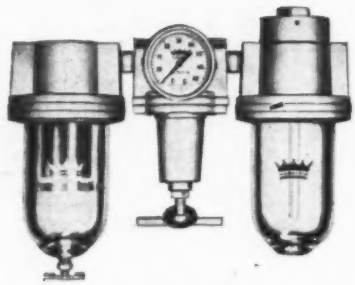

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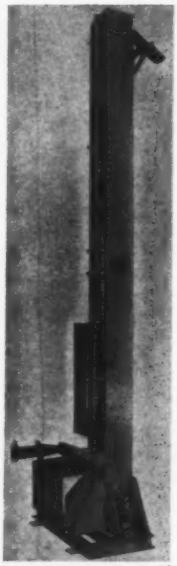

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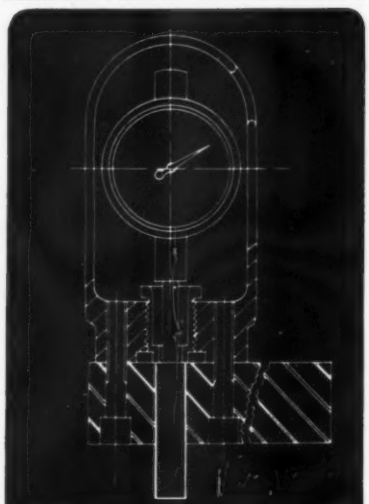

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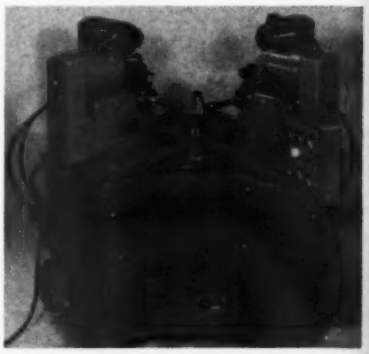

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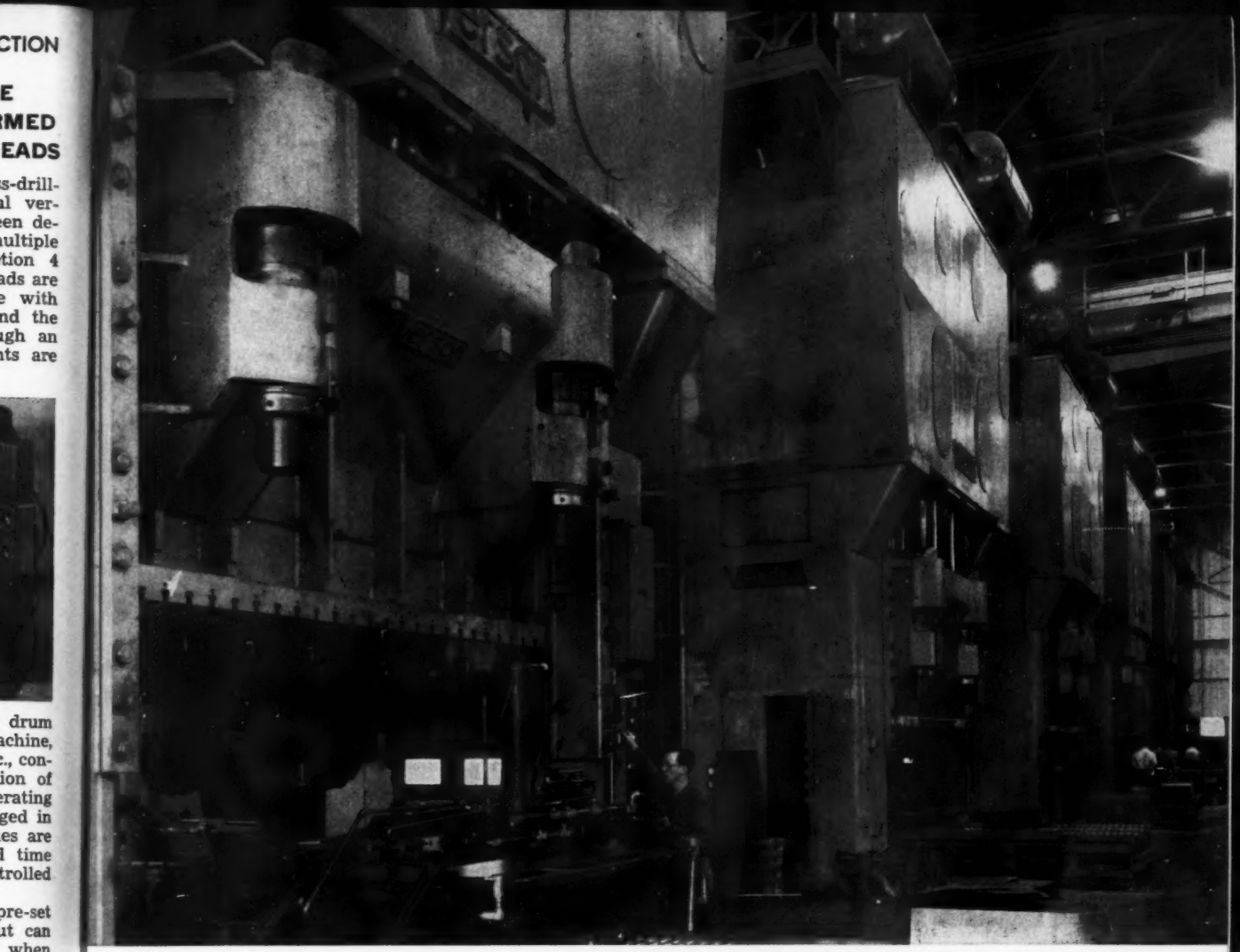

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